DEPARTMENT OF COMMERCE AND LABOR

BUREAU OF THE CENSUS

S. N. D. NORTH, DIRECTOR

MANUFACTURES

1905

PART IV

SPECIAL REPORTS ON SELECTED INDUSTRIES

WASHINGTON
GOVERNMENT PRINTING OFFICE
1908

CONTENTS.

PART IV.

	Page.
IRON AND STEEL	3-83
The iron and steel industry	3-22
Table 1.—Iron and steel—comparative summary, with per cent of increase: 1870 to 1905	4
Table 2.—Iron and steel—comparative summary, by states: 1880 to 1905	5
Comparative production by states	7
Table 3.—Iron and steel—quantity of classified products, by states, with rank of states: 1870 to 1905	7
Capital	8
Table 4.—Iron and steel—active and idle establishments—capital: 1880 to 1905	8
Table 5.—Iron and steel—active and idle establishments—capital, by branches: 1880 to 1905	8
Table 6.—Iron and steel—active and idle establishments—capital, by states: 1880 to 1905	9
Miscellaneous expenses	10
Wage-earners	10
Table 7.—Iron and steel—wage-earners (men, women, and children), with per cent of total, by branches: 1880 to 1905.	11
Materials used	11
Table 8.—Iron and steel—fuel consumed, by kind, quantity, and cost, by branches: 1880 to 1905	12
Table 9.—Iron and steel—quantity and cost of iron ore, mill cinder, and fluxing material consumed, by branches: 1880 to 1905	13
Table 10.—Iron and steel—quantity and cost of iron and steel used as material: 1880 to 1905	13
Production of iron and steel	13
Table 11.—Iron and steel—quantity of classified products, with per cent of increase, by branches: 1880 to 1905	14
Number, equipment, and capacity of iron and steel establishments	14
Table 12.—Iron and steel—active and idle establishments—number, equipment, and capacity: 1880 to 1905	14
Table 13.—Iron and steel—establishments, other than steel works and rolling mills, having steel works or rolling mill equipment: 1905	15
Iron and steel industry, by geographic divisions	15
Table 14.—Iron and steel—comparative summary, by branches and geographic divisions: 1880 to 1905	16
Table 15.—Iron and steel—per cent of increase in principal items, by branches and geographic divisions: 1880 to 1905.	18
Table 16.—Iron and steel—per cent of total capital and products, by branches and geographic divisions: 1880 to 1905.	20
Per cent of total value and quantity of products, by branches and geographic divisions: 1880 to 1905	21
The New England states	21
The Middle states	21
The Southern states	22
The Western states	22
The electrothermic metallurgy of iron and steel	22-24
Blast furnaces	24-48
Table 17.—Blast furnaces—comparative summary, with per cent of increase: 1870 to 1905	25
Relation of capital and specified items of expense to products	25
Table 18.—Blast furnaces—comparative summary, by states: 1880 to 1905	27
Capital	28
Table 19.—Blast furnaces—active and idle establishments—capital: 1880 to 1905	28
Materials used	28
Table 20.—Blast furnaces—materials used, by kind, quantity, and cost, with per cent of increase: 1880 to 1905	28
Products	29
Table 21.—Blast furnaces—production of pig iron, including direct castings, classified according to kind of fuel used, with per cent of total: 1880 to 1905	29
Table 22.—Blast furnaces—quantity and value of products, classified according to kind of fuel used, with per cent of increase: 1880 to 1905	29
Table 23.—Blast furnaces—quantity and value of all kinds of pig iron, with average value per ton, by states: 1880 to 1905	30
Table 24.—Blast furnaces—quantity of pig iron, by grades, with number of establishments reporting, by states: 1905 and 1900	32

Page.

IRON AND STEEL—Continued.
Blast furnaces—Continued.
Products—Continued.
Table 25.—Blast furnaces—quantity and value of direct castings, and spiegeleisen and ferromanganese, classified according to the kind of fuel used: 1905 and 1900 35
Pig iron production, distributed by classes of establishments and by states: 1905 35
Quantity of metal, classified according to method of handling, by states: 1905 36
Equipment and production 36
Table 26.—Blast furnaces—number of active and idle furnaces and production of pig iron, with per cent of total, by states, ranked according to quantity of product: 1880 to 1905 36
Table 27.—Blast furnaces—number of active and idle furnaces, by states: 1905 and 1900 37
Table 28.—Blast furnaces—number and capacity of completed furnaces, classified according to kind of fuel used, by states: 1880 to 1905 38
Slag pits 40
Pig iron exported 40
Power 40
The manufacture of pig iron with mineral fuel 41
Table 29.—Blast furnaces, mineral fuel—comparative summary, with per cent of increase: 1880 to 1905 41
Table 30.—Blast furnaces, mineral fuel—comparative summary, by states: 1880 to 1905 42
Capital 43
Table 31.—Blast furnaces, mineral fuel—active and idle establishments—capital: 1880 to 1905 43
Materials used 43
Table 32.—Blast furnaces, mineral fuel—materials used, by kind, quantity, and cost: 1880 to 1905 43
Materials consumed per ton of pig iron—mineral fuel 44
Products 44
Table 33.—Blast furnaces, mineral fuel—products, by quantity and value, classified according to kind of fuel used: 1880 to 1905 44
Table 34.—Blast furnaces, mineral fuel—quantity and value of pig iron, with average value per ton, by states: 1880 to 1905 45
Dry-air blast 45
The manufacture of charcoal pig iron 46
Table 35.—Blast furnaces, charcoal—comparative summary, with per cent of increase: 1880 to 1905 46
Capital 47
Table 36.—Blast furnaces, charcoal—active and idle establishments—capital: 1880 to 1905 47
Materials used 47
Table 37.—Blast furnaces, charcoal—materials used, by kind, quantity, and cost: 1880 to 1905 47
Products 48
Table 38.—Blast furnaces, charcoal—products, by kind, quantity, and value: 1880 to 1905 48
Table 39.—Blast furnaces, charcoal—quantity and value of pig iron, with average value per ton: 1880 to 1905 48
Steel works and rolling mills 48-70
Table 40.—Steel works and rolling mills—comparative summary, with per cent of increase: 1870 to 1905 49
Table 41.—Steel works and rolling mills—comparative summary, by states: 1880 to 1905 49
Capital 51
Table 42.—Steel works and rolling mills—active and idle establishments—capital: 1880 to 1905 51
Materials used 51
Table 43.—Steel works and rolling mills—materials used, by kind, quantity, and cost, with per cent of increase: 1880 to 1905 52
Products 52
Table 44.—Steel works and rolling mills—products, by kind, quantity, and value: 1880 to 1905 52
Table 45.—Steel works and rolling mills—detailed summary of products: 1905 53
Iron and steel rails 53
Splice bars 54
Bars and rods 54
Wire rods 54
Structural shapes 54
Iron and steel hoops, bands, cotton ties, and skelp 54
Car axles 55
Muck and scrap bar produced for sale 55
Boiler and other plates and sheets, except nail and tack plates, black plates or sheets for tinning, and armor plate 55
Nail and tack plate 55
Black plates or sheets for tinning 55
Armor plate and gun forgings 56
Rolled blooms, slabs, billets, tin-plate bars, and sheet bars produced for sale 56
Steel ingots produced for sale 56
Direct steel castings 56
Miscellaneous rolled products 56
Miscellaneous forged, cast, or other iron and steel products 56

IRON AND STEEL—Continued. Page.
Steel works and rolling mills—Continued.
Products—Continued.
Total production of steel castings and of rolled and forged iron and steel, by states 56
Table 46.—Steel works and rolling mills—quantity of classified products, with per cent of total, by states: 1880 to 1905 57
Miscellaneous secondary products 57
Nails 57
Table 47.—Steel works and rolling mills—principal iron and steel miscellaneous secondary products of rolling mills and establishments other than rolling mills: 1905 58
Wire 59
Wire manufactured—comparative summary: 1905 and 1900 59
Bolts, nuts, rivets, forged spikes, washers, etc 59
Wrought pipe 60
Seamless-drawn, clinched, brazed, etc., pipe or tubes 60
Horse and mule shoes 60
Springs 60
Equipment 60
Table 48.—Steel works and rolling mills—active and idle establishments—number, equipment, and capacity: 1880 to 1905 61
Steel production 61
Table 49.—Steel works—quantity of steel ingots and direct steel castings, by states: 1880 to 1905 61
Table 50.—Steel works—capacity of plants and quantity and value of steel ingots and castings, by states: 1905 63
Table 51.—Steel works—quantity and value of steel ingots, by kind and states: 1905 63
Table 52.—Steel works—quantity and value of steel castings, by kind and states: 1905 64
Bessemer steel 64
Table 53.—Bessemer steel works—number, equipment, and capacity of establishments, and quantity and value of ingots and castings, by states: 1905 64
Table 54.—Bessemer steel works—number, kind, and capacity of converters, by states: 1905 65
Open-hearth steel 65
Table 55.—Open-hearth steel works—number of establishments and furnaces, and quantity and value of steel produced, by states: 1905 66
Table 56.—Open-hearth steel works—quantity and value of ingots and castings, by kind and states: 1905 67
Table 57.—Open-hearth steel works—number and daily capacity of acid and basic furnaces, by states: 1905 and 1900 68
Crucible and miscellaneous steels 69
Table 58.—Crucible steel works—number, equipment, and capacity of establishments, and quantity and value of ingots and castings, by states: 1905 69
Forges and bloomeries 70, 71
Table 59.—Forges and bloomeries—comparative summary: 1870 to 1905 70
Table 60.—Forges and bloomeries—active and idle establishments—capital: 1880 to 1905 70
Table 61.—Forges and bloomeries—materials used, by kind, quantity, and cost: 1880 to 1905 71
Table 62.—Forges and bloomeries—products, by kind, quantity, and value: 1880 to 1905 71
Table 63.—Blast furnaces—detailed summary, by states: 1905 72
Table 64.—Blast furnaces—idle establishments—capital, equipment and capacity, and power, by states: 1905 76
Table 65.—Steel works and rolling mills—detailed summary, by states: 1905 76
Table 66.—Steel works and rolling mills—idle establishments—capital, equipment and capacity, and power, by states: 1905 .. 82
TIN AND TERNE PLATE 87–97
The combined industry—tin and terne dipping and black plate 87–90
Table 1.—Combined industry—comparative summary, with per cent of increase: 1905 and 1900 87
Table 2.—Combined industry—active and idle establishments—capital, by industries: 1905 and 1900 88
Table 3.—Combined industry—active and idle establishments—capital: 1905 and 1900 88
Table 4.—Combined industry—comparative summary, by states: 1905 and 1900 89
Table 5.—Combined industry—materials used, by kind, quantity, and cost, with per cent of increase: 1905 and 1900 89
Table 6.—Combined industry—net value of products, with per cent of increase: 1905 and 1900 90
The tin and terne dipping industry 90–94
Table 7.—Tin and terne dipping industry—comparative summary, with per cent of increase: 1905 and 1900 90
Table 8.—Tin and terne dipping industry—active and idle establishments—capital: 1905 and 1900 90
Table 9.—Tin and terne dipping industry—comparative summary, by states: 1905 and 1900 91
Table 10.—Tin and terne dipping industry—materials used, by kind, quantity, and cost, with per cent of increase: 1905 and 1900 91
Table 11.—Tin and terne dipping industry—comparative summary of products, by states: 1905 and 1900 92
Table 12.—Tin plate, terne plate, and taggers tin produced, imported, exported, and retained for consumption: 1890 to 1905. 92
Table 13.—Tin and terne dipping industry—active and idle establishments—number, equipment, and daily capacity, by states: 1905 and 1900 93
The black plate industry 94–96
Table 14.—Black plate industry—comparative summary, with per cent of increase: 1905 and 1900 94

TIN AND TERNE PLATE—Continued. Page.
The black plate industry—Continued.
Table 15.—Black plate industry—active and idle establishments—capital: 1905 and 1900 ... 94
Table 16.—Black plate industry—comparative summary, by states: 1905 and 1900 ... 95
Table 17.—Black plate industry—materials used, by kind, quantity, and cost, with per cent of increase: 1905 and 1900 ... 95
Table 18.—Black plate industry—comparative summary of products, by states: 1905 and 1900 ... 95
Table 19.—Black plate industry—active and idle establishments—number, equipment, and capacity, by states: 1905 and 1900 ... 96
Table 20.—Tin and terne plate—detailed summary, by states: 1905 ... 96
Table 21.—Tin and terne plate—idle establishments—capital, capacity, and power: 1905 ... 97
COPPER, LEAD, AND ZINC, SMELTING AND REFINING ... 101–126
The combined industry ... 101–103
Table 1.—Copper, lead, and zinc, smelting and refining—comparative summary, by industries, with per cent of increase: 1905 and 1900 ... 101
Copper and lead, smelting and refining—quantity of principal products, with amount and per cent of increase: 1905 and 1900. 102
Copper smelting and refining ... 103–113
Table 2.—Copper smelting and refining—comparative summary, with per cent of increase: 1905 and 1900 ... 103
Table 3.—Copper smelting and refining—idle establishments: 1905 ... 103
Table 4.—Copper smelting and refining: 1890 ... 103
Table 5.—Production of copper in the United States: 1845 to 1904 ... 104
The industry, by states and territories ... 104
Table 6.—Copper smelting and refining—comparative summary, by states and territories: 1905 and 1900 ... 105
Table 7.—Copper smelting and refining—comparative summary of establishments, by location, east and west of the Mississippi river, with per cent of increase: 1905 and 1900 ... 105
Refining Lake Superior mineral: 1905 ... 106
Materials used ... 106
Table 8.—Copper smelting and refining—materials used, by kind, quantity, and cost, with number of establishments reporting: 1905 and 1900 ... 106
Table 9.—Copper smelting and refining—principal materials used, by kind and quantity, and by states and territories: 1905 and 1900 ... 106
Table 10.—Copper smelting and refining—establishments classified according to kind of materials used: 1905 and 1900. 107
Table 11.—Copper smelting and refining—salaries, wages, miscellaneous expenses, and cost of materials for establishments classified according to kind of materials used, with per cent which each item forms of total: 1905 and 1900 ... 108
Products ... 108
Table 12.—Copper smelting and refining—products, by kind, quantity, and value, with number of establishments reporting: 1905 and 1900 ... 108
Table 13.—Copper smelting and refining—principal products, by kind and quantity, and by states and territories: 1905 and 1900 ... 109
Process employed—smelting, refining, and smelting and refining ... 109
Table 14.—Copper smelting and refining—establishments classified according to process employed: 1905 and 1900 ... 110
Table 15.—Copper smelting and refining—salaries, wages, miscellaneous expenses, and cost of materials for establishments classified according to process employed, with per cent which each item forms of total: 1905 and 1900 ... 111
Gross and net values of products ... 111
Table 16.—Copper smelting and refining—establishments reporting gross and net values of products: 1905 ... 111
Table 17.—Copper smelting and refining—detailed summary, by states and territories: 1905 ... 112
Lead smelting and refining ... 113–122
Table 18.—Lead smelting and refining—comparative summary, with per cent of increase: 1905 and 1900 ... 113
Table 19.—Lead smelting and refining—idle establishments: 1905 ... 113
Table 20.—Lead smelting and refining: 1890 ... 114
Table 21.—Production of refined lead in the United States: 1873 to 1904 ... 114
Table 22.—Lead smelting and refining—production of refined lead, by states: 1905 and 1900 ... 114
The industry, by states ... 114
Table 23.—Lead smelting and refining—comparative summary, by states: 1905 and 1900 ... 114
Table 24.—Lead smelting and refining—comparative summary of establishments, by location, east and west of the Mississippi river: 1905 and 1900 ... 115
Table 25.—Lead smelting and refining—comparative summary of materials and products, net cost and value, in establishments, by location, east and west of the Mississippi river: 1905 and 1900 ... 116
Table 26.—Lead smelting and refining—statistics of Missouri smelters: 1890 to 1905 ... 116
Materials used ... 116
Table 27.—Lead smelting and refining—quantity of ore smelted and base bullion refined and desilverized, by states: 1905 and 1900 ... 116
Products ... 116
Table 28.—Lead smelting and refining—principal products, by kind, quantity, and value, with number of establishments reporting: 1905 and 1900 ... 117
Lead smelting and refining—quantity and value of principal products, with per cent of increase: 1905 and 1900 ... 117
Table 29.—Lead smelting and refining—principal products, by kind and quantity, and by states: 1905 and 1900 ... 118

COPPER, LEAD, AND ZINC, SMELTING AND REFINING—Continued. Page.
Lead smelting and refining—Continued.
Process employed—smelting, and smelting and refining ... 118
Table 30.—Lead smelting and refining—establishments classified according to process employed, with per cent of increase: 1905 and 1900 ... 119
Table 31.—Lead smelting and refining—comparative summary of materials and products, net cost and value, classified according to process employed: 1905 and 1900 ... 120
Gross and net values of products ... 120
Table 32.—Lead smelting and refining—establishments reporting gross and net values of products: 1905 ... 120
Table 33.—Lead smelting and refining—detailed summary, by states: 1905 ... 121
Zinc smelting ... 122–126
Table 34.—Zinc smelting—comparative summary, with per cent of increase: 1890 to 1905 ... 122
Table 35.—Zinc smelting—idle establishments: 1905 ... 122
Table 36.—Production of spelter in the United States: 1873 to 1904 ... 122
The industry, by states ... 123
Table 37.—Zinc smelting—comparative summary, by states: 1905 and 1900 ... 123
Table 38.—Zinc smelting—comparative summary of establishments, by location, east and west of the Mississippi river: 1905 and 1900 ... 123
Table 39.—Zinc smelting—comparative summary of establishments arranged according to location: 1905 and 1900 ... 124
Products ... 124
Table 40.—Zinc smelting—products, by kind, quantity, and value: 1905 and 1900 ... 125
Table 41.—Zinc smelting—detailed summary, by states: 1905 ... 125
AGRICULTURAL IMPLEMENTS ... 129–153
Table 1.—Comparative summary, with per cent of increase: 1850 to 1905 ... 129
The industry, by geographic divisions ... 131
Table 2.—Per cent distribution of establishments, capital, and value of products, with per cent of increase, by geographic divisions: 1905 and 1900 ... 131
The industry, by states ... 131
Table 3.—Comparative summary, by states and geographic divisions: 1905 and 1900 ... 131
Rank of the three states leading in value of products in 1905: 1850 to 1905 ... 133
The industry in cities ... 134
Table 4.—Summary for cities having a population in 1900 of 20,000 or over: 1905 ... 134
Products ... 134
Table 5.—Number and kind of principal agricultural implements manufactured, by states: 1905 ... 135
Table 6.—Kind and value of products, by states: 1905 ... 135
Table 7.—Comparative summary—number and kind of agricultural implements manufactured: 1870 to 1905 ... 136
Table 8.—Number of establishments reporting each kind of implement, with the total number manufactured: 1905 ... 137
Table 9.—Industries manufacturing agricultural implements as a minor product, with number of establishments and value of such products, by kinds: 1905 ... 138
Table 10.—Establishments manufacturing agricultural implements as a minor product, and value of such products, by states: 1905 ... 138
Power ... 139
Table 11.—Power—comparative summary, with per cent each kind is of the total: 1905 and 1900 ... 139
Patents in relation to agricultural implements ... 139
Table 12.—Patents granted to June 5, 1906 ... 139
Exports ... 139
Table 13.—Value of exports of agricultural implements: years ending June 30, 1900 to 1905 ... 139
Table 14.—Agricultural implements—detailed summary, by states: 1905 ... 142
Maps and diagrams:
Map 1.—States having products valued at $100,000 and over: 1905 ... 133
Map 2.—States having products valued at $100,000 and over: 1900 ... 133
Diagram 1.—Comparative growth of the value of products, by geographic divisions: 1850 to 1905 ... 130
Diagram 2.—Growth of the total value of exports and of total value of exports to specified countries: 1890 to 1905 ... 140
ELECTRICAL MACHINERY, APPARATUS, AND SUPPLIES ... 157–221
Table 1.—Comparative summary, with per cent of increase: 1880 to 1905 ... 158
Table 2.—Comparative summary, by states: 1905 and 1900 ... 159
Products in detail ... 160–217
Dynamos ... 161
Table 3.—Dynamos—number, horsepower, and value: 1905 and 1900 ... 161
Table 4.—Dynamotors, motor generators, and boosters—number, horsepower, and value. 1905 and 1900 ... 166
Motors ... 167
Table 5.—Motors—number, horsepower, and value: 1905 and 1900 ... 167
Transformers ... 173
Table 6.—Transformers—number, horsepower, and value: 1905 and 1900 ... 173
Switchboards ... 174
Table 7.—Switchboards for light and power—value: 1905 and 1900 ... 174
Batteries ... 176
Table 8.—Batteries, storage and primary—value: 1905 and 1900 ... 176

ELECTRICAL MACHINERY, APPARATUS, AND SUPPLIES—Continued. Page.
Products in detail—Continued.
Carbons 179
Table 9.—Carbons—value: 1905 and 1900 179
Arc lamps and searchlights 180
Table 10.—Arc lamps—number and value: 1905 and 1900 180
Table 11.—Searchlights and projectors—number and value: 1905 and 1900 183
Incandescent lamps 183
Table 12.—Incandescent, and decorative and minature lamps, etc.—number and value: 1905 and 1900 183
Lighting fixtures 190
Table 13.—Electric light fixtures—value: 1905 and 1900 190
Telephone apparatus 191
Table 14.—Telephones and telephone apparatus—number and value: 1905 192
Telegraph apparatus 200
Table 15.—Telegraph apparatus—number and value: 1905 and 1900 200
Insulated wires and cables 204
Table 16.—Insulated wires and cables—value: 1905 and 1900 204
Conduits 206
Table 17.—Electric conduits—value: 1905 and 1900 206
Annunciators and clocks 207
Table 18.—Annunciators—number and value: 1905 and 1900 207
Table 19.—Electric clocks and time mechanisms—number and value: 1905 and 1900 208
Rheostats and resistances 208
Table 20.—Rheostats and resistances—number and value: 1905 208
Heating apparatus 210
Table 21.—Electric heating, cooking, and welding apparatus—number and value: 1905 210
Fuses and lightning arresters 211
Table 22.—Fuses and lightning arresters—number and value: 1905 and 1900 212
Electric measuring instruments 213
Table 23.—Electric measuring instruments—number and value: 1905 and 1900 213
Circuit fittings 214
Table 24.—Circuit fittings of all kinds—number and value: 1905 214
All other products 215
Table 25.—All other products—value: 1905 and 1900 215
Custom work and repairing 217
Table 26.—Amount received for custom work and repairing: 1905 and 1900 217
Table 27.—Electrical machinery, apparatus, and supplies—detailed summary, by states: 1905 218
Illustrations: Facing page.
Building up the armature of a large electric generator 160
Constructing a large alternating current transformer 160
Three 500-kilowatt turbine direct connected generators installed in a railroad repair shop 162
Factory equipped with steam turbine dynamo electric units for supplying light and power 162
Steam turbine generator sets in engine room of a Hudson river steamboat 164
Twenty-four hundred kilowatt steam turbine generator at a coal mine in Kentucky 164
Winding armatures for electric generators 166
Railroad shop with tools equipped with motors on multiple voltage system 166
Floor of electric factory for assembling electric railway motors 168
Keyboard cables for telephone exchange. (Skeleton of switchboard section in the rear.) 192
Telephone switchboard, showing rear view of subscribers' sections, with multiple cables, answering jack cables, cord circuit cables, and relays 194

Page.
METAL WORKING MACHINERY 225–236
Table 1.—Metal working machinery—value of products, by states, with per cent of total and per cent of increase: 1905 and 1900 225
Table 2.—Exports and imports of iron and steel manufactures and total machinery, and exports of metal working machinery: 1900 to 1904 226
Table 3.—Metal working machinery—value of products, by class of machines, with per cent each class is of the total and per cent of increase: 1905 and 1900 227
Table 4.—Production of lathes, including automatic, hand, engine, turret, and semiautomatic, by states: 1905 and 1900 227
Table 5.—Production of milling machines, including all machines using a milling cutter, by states: 1905 and 1900 227
Table 6.—Production of boring and drilling machinery, by states: 1905 and 1900 228
Table 7.—Production of stamping, flanging, and forming machines for plate and sheet metal, by states: 1905 and 1900 228
Table 8.—Production of pneumatic hand machines: 1905 and 1900 228
Table 9.—Production of planers, including plate edge planers, by states: 1905 and 1900 228
Table 10.—Production of punching and shearing machines, by states: 1905 and 1900 229
Table 11.—Production of grinding and polishing machinery, by states: 1905 and 1900 229
Table 12.—Production of boring and turning mills, or vertical lathes, by states: 1905 and 1900 229
Table 13.—Production of bolt, nut, and pipe threading and tapping machines, by states: 1905 and 1900 229
Table 14.—Production of slotters and shapers, by states: 1905 and 1900 230

METAL WORKING MACHINERY—Continued. Page.
Table 15.—Production of hammers—steam, power, and drop—by states: 1905 and 1900 230
Table 16.—Production of forging machines, by states: 1905 and 1900 230
Table 17.—Production of riveting machines, by states: 1905 and 1900 230
Table 18.—Production of bending and straightening rolls, by states: 1905 and 1900 230
Table 19.—Production of sawing machines, by states: 1905 and 1900 231
Table 20.—Production of "all other metal working machinery," by states: 1905 231
Development of the industry 231–236
Foreign use of American tools 231
Specialization in manufacture 232
High speed steel 232
Speed adjustment 232
Portable tools 233
Automatics 233
New grinding process 235
Interchangeable tools 235
Illustrations: Facing page.
Lathe arranged for driving by a constant-speed belt 232
Rear view of lathe driven by electric motor 232
Multiple-spindle automatic screw machine 234
Automatic screw machine for working bars 6 inches in diameter 234
Automatic screw machine with magazine attachment 236
Automatic screw machine 236

Page.
MUSICAL INSTRUMENTS, ATTACHMENTS, AND MATERIALS 239–266
The combined industry 239–242
Table 1.—Musical instruments, attachments, and materials—comparative summary, with per cent of increase: 1860 to 1905. 239
Table 2.—Musical instruments, attachments, and materials—summary, by industries, with per cent of total: 1905 240
Table 3.—Musical instruments, pianos and organs—products of each industry, by kind, quantity, and value: 1905 240
Table 4.—Musical instruments, attachments, and materials—comparative summary, by selected states: 1880 to 1905 241
Table 5.—Musical instruments, attachments, and materials—value of exports and imports compared with value of domestic production: 1870 to 1905 242
Pianos 242–245
Table 6.—Pianos, including piano players and attachments—kind and value, with per cent of total and per cent of increase: 1905 and 1900 243
Table 7.—Pianos, upright and grand—number and value, with per cent of total value, by states: 1905 and 1900 243
Organs 245–248
Table 8.—Organs—kind and value, with per cent of total and per cent of increase: 1905 and 1900 245
Table 9.—Reed organs—number and value, with per cent of total value, by states: 1905 and 1900 245
Table 10.—Pipe organs—number and value, with per cent of total value, by states: 1905 and 1900 247
Self-playing and street pianos and organs, and piano players and attachments 248, 249
Table 11.—Self-playing and street pianos and organs, and piano players and attachments—kind and value, with per cent of total and per cent of increase: 1905 and 1900 248
Table 12.—Piano players and piano playing attachments—number and value, with per cent of total value: 1905 and 1900 .. 248
Table 13.—Self-playing pianos and organs—number and value, with per cent of total value: 1905 and 1900 248
Piano and organ materials 250, 251
Table 14.—Piano and organ materials—value of products, by states: 1905 250
Table 15.—Piano materials and parts—distribution of value, by kind: 1905 250
Table 16.—Organ materials and parts—distribution of value, by kind: 1905 251
Table 17.—Musical instruments, pianos—detailed summary, by states: 1905 252
Table 18.—Musical instruments, organs—detailed summary, by states: 1905 256
Table 19.—Musical instruments, piano and organ materials—detailed summary, by states: 1905 258
Table 20.—Musical instruments and materials, not specified—detailed summary, by states: 1905 260
Phonographs and graphophones 264–266
Table 21.—Phonographs and graphophones—comparative summary, with per cent of increase: 1905 and 1900 264
Table 22.—Phonographs and graphophones—products, by kind and value, with per cent of total and per cent of increase: 1905 and 1900 264
Table 23.—Phonographs and graphophones—detailed summary, by states: 1905 266
AUTOMOBILES 269–285
Table 1.—Comparative summary, with per cent of increase: 1905 and 1900 269
Table 2.—Miscellaneous expenses: 1905 and 1900 269
Table 3.—Comparative summary, by states: 1905 and 1900 270
Table 4.—Number and value of automobiles, by class and kind of power used: 1905 272
Table 5.—Average value of automobiles, by class and kind of power used: 1905 273
Table 6.—Rank of leading states with respect to principal items of inquiry: 1905 and 1900 273
Table 7.—Summary for cities having a population in 1900 of at least 20,000: 1905 274
Table 8.—Power—comparative summary: 1905 and 1900 274
Automobiles as a minor product 274, 275

AUTOMOBILES—Continued. Page.
- Allied industries ... 275
  - Automobile bodies and parts ... 275
    - Table 9.—Summary—automobiles and automobile bodies and parts: 1905 ... 275
  - Rubber and elastic goods ... 275
    - Table 10.—Rubber and elastic goods—comparative summary: 1905 and 1900 ... 275
- Imports and exports ... 275–277
  - Table 11.—Value of exports of automobiles and automobile parts, for years ending June 30: 1902 to 1905 ... 276
  - Table 12.—Automobiles and automobile parts imported and entered for consumption during the fiscal years ending June 30: 1901 to 1905 ... 276
- Statistical summary ... 277
- Historical and descriptive ... 277–280
  - The modern automobile ... 277
  - Steam motors ... 278
  - Petrol motors ... 278
  - Electric motors ... 279
  - Frame, wheels, and body ... 279
- Table 13.—Automobiles—detailed summary, by states: 1905 ... 282

BICYCLES AND TRICYCLES ... 289–297
- Table 1.—Comparative summary, with per cent of increase and decrease: 1890 to 1905 ... 289
- Production ... 289
  - Table 2.—Number and value of different kinds of products, including those produced as secondary products: 1905 and 1900 ... 289
- Table 3.—Comparative summary, active establishments, by states, with increase and decrease: 1890 to 1905 ... 290
- Table 4.—Comparative summary, by states: 1905 and 1900 ... 291
- Exports ... 291
  - Table 5.—Value of exports of bicycles and tricycles, and parts thereof: 1896 to 1905 ... 291
- Historical and descriptive ... 291, 292
- Table 6.—Bicycles and tricycles—detailed summary, by states: 1905 ... 294

CARRIAGES AND WAGONS ... 301–327
- Table 1.—Comparative summary, with per cent of increase: 1890 to 1905 ... 301
- The industry, by states and territories ... 301
  - Table 2.—Comparative summary, by states, territories, and geographic divisions: 1905 and 1900 ... 302
- The industry in cities ... 304
- Materials used ... 304
  - Table 3.—Materials used, by kind, quantity, and cost, with per cent of increase: 1905 and 1900 ... 304
- Products ... 304
  - Table 4.—Products, by kind, quantity, and value, with per cent of increase: 1905 and 1900 ... 304
  - Table 5.—Products, by kind, quantity, and value—comparative summary, by states and territories: 1905 and 1900 ... 305
- Exports and imports ... 307
  - Exports and imports of carriages and wagons, and parts thereof: 1900 to 1905 ... 307
- Carriage and wagon materials ... 307
  - Table 6.—Carriage and wagon materials—comparative summary: 1890 to 1905 ... 307
- Table 7.—Carriages and wagons—detailed summary, by states and territories: 1905 ... 310

SHIPBUILDING ... 331–353
- The combined industry ... 331–335
  - Table 1.—Comparative summary, with per cent of increase: 1850 to 1905 ... 331
  - Branches of the industry ... 332
    - Table 2.—Comparative summary, by branches: 1905 and 1900 ... 332
  - Materials used ... 333
    - Table 3.—Materials used, by kind and cost, with per cent of total: 1890 to 1905 ... 333
  - Products ... 333
    - Table 4.—Products, by kind and value, with per cent of total: 1880 to 1905 ... 333
    - Table 5.—Rank, according to capital and value of products, of states having products valued at one million dollars and over for 1905: 1880 to 1905 ... 334
  - The industry by watershed districts ... 334
    - Table 6.—Summary, by watershed districts, with per cent of total: 1905 ... 334
    - Table 7.—Comparative summary for the Great Lakes district, by branches, with per cent of increase: 1905 and 1900 ... 335
- Governmental establishments ... 335
  - Table 8.—Governmental establishments—comparative summary, with per cent of increase: 1905 and 1900 ... 335
- Vessels launched, small boats, and repair work ... 335–343
- Vessels of five tons and over ... 336
  - Table 9.—Number, tonnage, and value of vessels of five tons and over launched by private shipyards, with per cent of increase: 1880 to 1905 ... 336
  - Table 10.—Number, tonnage, and value of vessels of five tons and over launched during 1904 by all establishments, classified according to service ... 337
  - Table 11.—Steel vessels of 1,000 tons and over for the United States Navy launched during 1904 by private shipyards ... 337
  - Table 12.—Steel vessels of 1,000 tons and over launched during 1904 by Government shipyards ... 337

SHIPBUILDING—Continued. Page.
Vessels of five tons and over—Continued.
Table 13.—Net tonnage of merchant vessels of five tons and over launched during 1904 by private shipyards, classified according to kind of trade, by geographic divisions 337
Table 14.—Number, tonnage, and value of vessels of five tons and over launched by private shipyards, classified according to motive power, with per cent of increase: 1880 to 1905 338
Table 15.—Number, tonnage, and value of vessels of five tons and over launched during 1904 by private shipyards, classified according to motive power, by watershed districts 339
Table 16.—Number, tonnage, and value of steel and wooden vessels of five tons and over launched by private shipyards on the Great Lakes, with per cent of increase: 1905 and 1900 339
Table 17.—Rank of principal states according to value of vessels of five tons and over launched by private shipyards: 1905 and 1900 339
Table 18.—Rank of principal states according to value of each class of vessels of five tons and over launched during 1904 by private shipyards 339
Steam and other power vessels 340
Table 19.—Value of iron and steel and wooden steam and other power vessels of five tons and over launched by private shipyards, with per cent of total: 1890 to 1905 340
Table 20.—Number, gross and net tonnage, and value of power vessels, other than steam, of five tons and over, launched during 1904 by private shipyards, by states 340
Barges 340
Table 21.—Value of iron and steel and wooden barges, with per cent of total: 1890 to 1905 340
Table 22.—Number, gross and net tonnage, and value of barges, by states: 1905 and 1900 341
Sail vessels 341
Table 23.—Value of iron and steel and wooden sail vessels of five tons and over launched by private shipyards, with per cent of total: 1890 to 1905 341
Table 24.—Number, gross and net tonnage, and value of sail vessels of five tons and over launched by private shipyards, by states: 1905 and 1900 341
Canal boats 341
Table 25.—Number, gross and net tonnage, and value of canal boats, by states: 1905 and 1900 342
Small boats 342
Table 26.—Number and value of boats under five tons, by states: 1905 and 1900 342
Repair work 343
Table 27.—Value of repair work reported by private and Government shipyards, with per cent of total and per cent of increase: 1905 and 1900 343
Table 28.—Value of repair work reported by private shipyards, by states: 1890 to 1905 343
Equipment of shipyards 343–346
Table 29.—Number of private shipyards and value of repair work, together with number of private shipyards reporting dry dock or marine railway equipment and value of their repair work: 1905 344
Dry docks 344
Table 30.—Number and kind of dry docks in private and Government shipyards, classified according to dimensions, by states and geographic divisions: 1905 344
Number and kind of dry docks at each naval station in the United States: 1905 345
Illustration—Floating dry dock *Dewey* Facing page 344
Marine railways 345
Table 31.—Number and lifting capacity of marine railways, classified according to dimensions and lifting capacity, by states and geographic divisions: 1905 346
Power 347
Table 32.—Number of private establishments reporting power owned or rented, and amount of each kind of power available for use, by branches: 1905 and 1900 347
Table 33.—Iron and steel shipbuilding—detailed summary, by states: 1905 348
Table 34.—Wooden shipbuilding, including boat building—detailed summary, by states: 1905 350
THE STEAM AND STREET RAILROAD CAR INDUSTRY 357–393
Steam railroad cars and repairs 357–385
Table 1.—Cars, steam railroad, and steam railroad repair shops—comparative summary, with per cent of increase: 1890 to 1905 357
Table 2.—Cars, steam railroad, and steam railroad repair shops—comparative summary, by industries, with per cent of increase: 1890 to 1905 358
Products 358
Table 3.—Number, kind, and value of steam railroad cars built by all establishments: 1905 and 1900 359
Table 4.—Cars, steam railroad, and steam railroad repair shops—comparative summary of products, by kind, quantity, and value, for the United States and ten leading states: 1905 and 1900 362
Cars, steam railroad 364
Table 5.—Cars, steam railroad—summary, by geographic divisions, 1905 364
Table 6.—Cars, steam railroad—comparative summary, by states: 1890 to 1905 365
Products 366
Table 7.—Cars, steam railroad—number and value of cars built, distributed according to kind: 1905 and 1900 366
Exports 367
Table 8.—Value of exports of steam railroad passenger and freight cars, and parts of same, by countries: 1880 to 1905. 367

THE STEAM AND STREET RAILROAD CAR INDUSTRY—Continued. Page.
Steam railroad cars and repairs—Continued.
Steam railroad repair shops 367
Table 9.—Steam railroad repair shops—summary, by geographic divisions: 1905 367
Table 10.—Steam railroad repair shops—comparative summary, by states and territories: 1890 to 1905 368
Table 11.—Cars, steam railroad, not including operations of railroad companies—detailed summary, by states: 1905 371
Table 12.—Cars and general shop construction and repairs by steam railroad companies—detailed summary, by states and territories: 1905 374
Street railroad cars and repairs 386–393
Table 13.—Cars, street railroad, and street railroad repair shops—comparative summary, with per cent of increase: 1890 to 1905 386
Table 14.—Cars, street railroad, and street railroad repair shops—comparative summary, by industries, with per cent of increase: 1890 to 1905 386
Products 387
Table 15.—Number, kind, and value of street railroad cars built by all establishments: 1905 387
Street railroad repair shops 388
Table 16.—Street railroad repair shops—summary, by geographic divisions: 1905 388
Table 17.—Cars, street railroad, not including operations of railroad companies—detailed summary, by states: 1905 389
Table 18.—Cars and general shop construction and repairs by street railroad companies—detailed summary, by states: 1905. 390
CHEMICALS AND ALLIED PRODUCTS 397–512
Scope of the census 397–403
Table 1.—Chemicals and allied products—comparative summary, with amount and per cent of increase: 1905 and 1900 ... 398
Table 2.—Comparative summary, by industries: 1905 and 1900 398
Table 3.—Increase and per cent of increase in the separate industries: 1900 to 1905 399
Table 4.—Number of establishments, by states and territories, with increase and rank: 1905 and 1900 399
Table 5.—Quantity and cost of materials used, with amount and per cent of increase, and average cost per unit: 1905 and 1900 400
Table 6.—Quantity and value of products, with amount and per cent of increase: 1905 and 1900 401
Table 7.—Products consumed in establishments where manufactured, with amount and per cent of increase: 1905 and 1900. 403
Class I. A.—Sulphuric, nitric, and mixed acids 403–417
Table 8.—Sulphuric, nitric, and mixed acids—comparative summary, with amount and per cent of increase: 1905 and 1900. 404
Sulphuric acid 404
Table 9.—Sulphuric acid—number of establishments and quantity and value of products: 1870 to 1905 404
Table 10.—Sulphuric acid—increase and per cent of increase in quantity and value of products: 1870 to 1905 404
Table 11.—Total quantity and value of sulphuric acid, by grades: 1890 to 1905 405
Table 12.—Sulphuric acid—number of establishments, by states and territories: 1905 and 1900 405
Table 13.—Sulphuric acid—quantity of products, by geographic divisions: 1905 and 1900 406
Table 14.—Pyrites produced in, and imported into, the United States: 1895 to 1904 407
Table 15.—Sulphur imported and entered for consumption in the United States: 1895 to 1904 407
Table 16.—Tons of real sulphuric acid and of chamber acid theoretically produced by a ton of each of the minerals specified 407
Contact process plants 410
Chamber process plants 411
Table 17.—Quantity of sulphuric acid consumed for specific purposes: 1900 411
Nitric acid 412
Table 18.—Nitric acid—quantity and value of products: 1905 and 1900 412
Table 19.—Nitric acid—number of establishments, by states: 1905 and 1900 412
Table 20.—Results of nitric acid distillation obtained with the first two Valentiner vacuum apparatus installed in the United States: 1904 414
Mixed acids 415
Table 21.—Mixed acids—quantity and value of products: 1905 and 1900 415
Table 22.—Mixed acids—number of establishments, by states: 1905 and 1900 415
Table 23.—Mixed acids—quantity of products, by geographic divisions: 1905 and 1900 416
Percentage composition of various mixed acids 416
Class I. B.—Other acids 417–420
Table 24.—"Other acids"—comparative summary, with amount and per cent of increase: 1905 and 1900 417
Muriatic acid 417
Table 25.—Muriatic acid—quantity and value of products: 1905 and 1900 417
Table 26.—Muriatic acid—number of establishments, by states: 1905 and 1900 418
Table 27.—Muriatic acid—quantity of products, by geographic divisions: 1905 and 1900 418
Table 28.—Muriatic acid produced with Cellarius jars during a twelve months' run 418
Acetic acid 418
Table 29.—Acetic acid—quantity and value of products: 1905 and 1900 418
Table 30.—Acetic acid—number of establishments, by states: 1905 and 1900 419
All other acids 419
Table 31.—Minor acids—number of establishments and quantity and value of products: 1905 and 1900 419
Table 32.—Acids—imports for consumption: 1891 to 1905 419
Bibliography 420

CHEMICALS AND ALLIED PRODUCTS—Continued. Page.
Class II.—Sodas 420–425
Table 33.—Sodas—comparative summary, with amount and per cent of increase: 1905 and 1900 421
Table 34.—Sodas—quantity and value, with per cent of increase: 1880 to 1905 421
Table 35.—Sodas—quantity and value of products, with amount and per cent of increase: 1890 to 1905 421
Table 36.—Sodas—number of establishments, by states: 1905 and 1900 422
Table 37.—Sodas—value of products, by geographic divisions: 1905 and 1900 422
Table 38.—World's production of sodas: 1850 to 1902 423
Table 39.—Sodas—imports entered for consumption: 1891 to 1905 425
Bibliography 425
Class III.—Potashes 425–428
Table 40.—Potashes—quantity and value of products: 1850 to 1905 426
Table 41.—Imports of potashes, ashes (wood) and lye of, and beet root ashes, entered for consumption; and domestic exports of potashes and pearlashes: 1891 to 1905 428
Class IV.—Alums 428–430
Table 42.—Alums—comparative summary, with amount and per cent of increase: 1905 and 1900 428
Table 43.—Alums—quantity and value: 1880 to 1905 428
Table 44.—Kinds of alum—quantity and value of products: 1905 and 1900 429
Table 45.—Alums—number of establishments, by states: 1905 and 1900 429
Table 46.—Alums—value of products, by states: 1905 and 1900 429
Table 47.—Alums, cryolite, and bauxite—imports for consumption: 1891 to 1905 430
Class V.—Coal tar products 430–432
Table 48.—Coal tar products—comparative summary, with amount and per cent of decrease: 1905 and 1900 430
Table 49.—Coal tar products—number of establishments, by states: 1905 and 1900 430
Table 50.—Coal tar products—value, by states: 1890 to 1905 431
Table 51.—Coal tar and coal tar products—imports for consumption: 1896 to 1905 432
Class VI.—Cyanides 432–434
Table 52.—Cyanides—comparative summary, with amount and per cent of decrease: 1905 and 1900 432
Table 53.—Cyanides—quantity and value of products, with amount and per cent of increase: 1905 and 1900 433
Table 54.—Cyanides—number of establishments, by states: 1905 and 1900 433
Table 55.—Cyanides—value of products, by states: 1905 and 1900 433
Table 56.—Cyanides—imports for consumption: 1891 to 1905 434
Bibliography 434
Class VII.—Wood distillation 434–437
Table 57.—Wood distillation—comparative summary, with amount and per cent of increase: 1905 and 1900 435
Table 58.—Wood distillation—crude products: 1880 to 1905 435
Table 59.—Wood distillation—crude products, increase and per cent of increase: 1880 to 1905 435
Table 60.—Wood distillation—number of establishments, by states: 1905 and 1900 436
Table 61.—Wood distillation—value of crude products, by states: 1905 and 1900 436
Table 62.—Pine wood distillation products: 1905 and 1900 436
Table 63.—Production of refined wood alcohol: 1890 to 1905 437
Table 64.—Wood distillation products—exports and imports: 1891 to 1905 437
Class VIII.—Fertilizers 437–441
Table 65.—Fertilizers—comparative summary, with amount and per cent of increase: 1905 and 1900 438
Table 66.—Fertilizers—quantity and value of products, with amount and per cent of increase: 1905 and 1900 438
Table 67.—Fertilizers—number of establishments, by states and territories: 1905 and 1900 438
Table 68.—Fertilizers—quantity and value of products, by states and geographic divisions: 1905 and 1900 439
Table 69.—Fertilizers—number of establishments and quantity and value of products, with amount and per cent of increase: 1860 to 1905 439
Table 70.—Fertilizers—quantity and cost of principal materials used, with amount and per cent of increase: 1905 and 1900. 440
Table 71.—Fertilizers—imports for consumption: 1890 to 1905 441
Class IX.—Bleaching materials 441–443
Table 72.—Bleaching materials—comparative summary, with amount and per cent of increase: 1905 and 1900 441
Table 73.—Bleaching materials—quantity and value of products, with amount and per cent of increase: 1905 and 1900 441
Table 74.—Bleaching materials—number of establishments, by states: 1905 and 1900 442
Table 75.—Bleaching materials—quantity and cost of principal components used, with amount and per cent of increase: 1905 and 1900 442
Table 76.—Bleaching materials—value of products, by states: 1905 and 1900 442
Table 77.—Peroxides now offered in commerce, other than sodium peroxide 443
Table 78.—Chloride of lime, or bleaching powder—imports: 1891 to 1905 443
Class X.—Chemicals produced by the aid of electricity 444–450
Table 79.—Electro-chemicals—comparative summary, with amount and per cent of increase: 1905 and 1900 444
Table 80.—Electro-chemicals—number of establishments, by states: 1905 and 1900 444
Table 81.—Electro-chemicals—value of products, by geographic divisions: 1905 and 1900 445
Table 82.—Electro-chemicals—quantity and cost of principal materials used, with amount and per cent of increase: 1905 and 1900 445
Table 83.—Aluminum—production, imports, exports, and consumption: 1897 to 1906 446
Table 84.—Plumbago—imports entered for consumption: 1891 to 1905 450

CHEMICALS AND ALLIED PRODUCTS—Continued. Page.

Class XI.—Dyestuffs ... 450–457
Table 85.—Dyestuffs—comparative summary, with amount and per cent of increase: 1905 and 1900 ... 450
Table 86.—Dyestuffs—quantity and value of products: 1905 and 1900 ... 451
Table 87.—Dyestuffs—number of establishments, by states: 1905 and 1900 ... 451
Table 88.—Dyestuffs—value of products, by states: 1905 and 1900 ... 451
Table 89.—Dyestuffs—quantity and cost of principal materials used: 1905 and 1900 ... 451
Table 90.—Dyestuffs and extracts—comparison of statistics: 1880 to 1905 ... 452
Cost of chemicals and dyestuffs used in all textile establishments: 1890 to 1905 ... 456
Table 91.—Dyestuffs—imports entered for consumption: 1891 to 1905 ... 457

Class XII.—Tanning materials ... 457–460
Table 92.—Tanning materials—comparative summary, with amount and per cent of increase: 1905 and 1900 ... 458
Table 93.—Tanning materials—quantity and value of products: 1905 and 1900 ... 458
Table 94.—Tanning materials—number of establishments, by states: 1905 and 1900 ... 458
Table 95.—Tanning materials—value of products, by states: 1905 and 1900 ... 458
Table 96.—Tanning materials—quantity and cost of principal materials used: 1905 and 1900 ... 459
Table 97.—Tanning materials used in the manufacture of leather: 1905 and 1900 ... 459
Table 98.—Tanning materials—imports for consumption and domestic exports: 1891 to 1905 ... 460

Class XIII.—Paints and varnishes ... 460–468
Table 99.—Paints and varnishes—comparative summary, with amount and per cent of increase: 1905 and 1900 ... 461
Table 100.—Paints and varnishes—quantity and value of products: 1905 and 1900 ... 461
Table 101.—Paints and varnishes—number of establishments, by states: 1905 and 1900 ... 462
Table 102.—Paints and varnishes—value of products, by geographic divisions: 1905 and 1900 ... 462
Table 103.—Paints and varnishes—quantity and cost of principal materials used: 1905 and 1900 ... 463
Table 104.—Paints and varnishes—comparative summary: 1850 to 1905 ... 463
Table 105.—Paints, pigments, and colors, and varnishes, spirits, and "all other"—imports and domestic exports: 1891 to 1905. 468

Class XIV.—Explosives ... 468–475
Table 106.—Explosives—comparative summary, with amount and per cent of increase: 1905 and 1900 ... 468
Table 107.—Explosives—quantity and value of products: 1905 and 1900 ... 468
Table 108.—Explosives—number of establishments, by states and territories: 1905 and 1900 ... 469
Table 109.—Explosives—value of products, by geographic divisions: 1905 and 1900 ... 469
Table 110.—Explosives—quantity and cost of materials used: 1905 and 1900 ... 470
Table 111.—Explosives—comparative summary: 1840 to 1905 ... 470
Table 112.—Gunpowder—quantity and value: 1840 to 1905 ... 470
Table 113.—Nitroglycerin—quantity and value: 1870 to 1905 ... 471
Table 114.—Dynamite—quantity and value: 1880 to 1905 ... 471
Percentage composition of various dynamites ... 472
Table 115.—Explosives—imports and domestic exports: 1891 to 1905 ... 475

Class XV.—Plastics ... 475–477
Table 116.—Plastics—comparative summary, with amount and per cent of increase: 1905 and 1900 ... 475
Table 117.—Plastics—quantity and value of products: 1905 and 1900 ... 475
Table 118.—Plastics—number of establishments, by states: 1905 and 1900 ... 476
Table 119.—Plastics—quantity and cost of materials used: 1905 and 1900 ... 476
Table 120.—Pyroxylin plastics—comparative summary: 1880 to 1905 ... 476
Table 121.—Pyroxylin plastics—imports and exports: 1891 to 1905 ... 477

Class XVI.—Essential oils ... 477, 478
Table 122.—Essential oils—comparative summary, with amount and per cent of increase: 1905 and 1900 ... 477
Table 123.—Essential oils—quantity and value of products: 1905 and 1900 ... 477
Table 124.—Essential oils—number of establishments, by states: 1905 and 1900 ... 478
Table 125.—Essential oils—value of products, by geographic divisions: 1905 and 1900 ... 478
Table 126.—Essential oils—quantity and cost of materials used: 1905 and 1900 ... 478
Table 127.—Oils, volatile, or essential, and distilled—imports and exports: 1891 to 1905 ... 478

Class XVII.—Compressed and liquefied gases ... 478–482
Table 128.—Compressed and liquefied gases—comparative summary, with amount and per cent of increase: 1905 and 1900. 479
Table 129.—Compressed and liquefied gases—quantity and value of products: 1905 and 1900 ... 479
Table 130.—Compressed and liquefied gases—number of establishments, by states: 1905 and 1900 ... 479
Table 131.—Compressed and liquefied gases—value of products, by geographic divisions: 1905 and 1900 ... 479
Table 132.—Compressed and liquefied gases—quantity and cost of materials used: 1905 and 1900 ... 480

Class XVIII.—Fine chemicals ... 482–485
Table 133.—Fine chemicals—comparative summary, with amount and per cent of increase: 1905 and 1900 ... 482
Table 134.—Fine chemicals—quantity and value of products: 1905 and 1900 ... 482
Table 135.—Fine chemicals—number of establishments, by states: 1905 and 1900 ... 483
Table 136.—Fine chemicals—value of products, by geographic divisions: 1905 and 1900 ... 483
Table 137.—Fine chemicals—quantity and cost of materials used: 1905 and 1900 ... 484
Table 138.—Fine chemicals—imports for consumption: 1891 to 1905 ... 485

CHEMICALS AND ALLIED PRODUCTS—Continued. Page.
Class XIX.—General chemicals 485–489
Table 139.—General chemicals—comparative summary, with amount and per cent of increase: 1905 and 1900 486
Table 140.—General chemicals—quantity and value of products: 1905 and 1900 486
Table 141.—General chemicals—number of establishments, by states: 1905 and 1900 487
Table 142.—General chemicals—value of products, by geographic divisions: 1905 and 1900 487
Table 143.—General chemicals—quantity and cost of principal materials used: 1905 and 1900 487
Table 144.—General chemicals—imports for consumption: 1891 to 1905 488
Table 145.—Chemicals—detailed summary, by states: 1905 490
Table 146.—Paints—detailed summary, by states: 1905 492
Table 147.—Fertilizers—detailed summary, by states: 1905 494
Table 148.—Explosives—detailed summary, by states: 1905 498
Table 149.—Varnishes—detailed summary, by states: 1905 500
Table 150.—Dyestuffs and extracts—detailed summary, by states: 1905 502
Table 151.—Sulphuric, nitric, and mixed acids—detailed summary, by states: 1905 504
Table 152.—Wood distillation—detailed summary, by states: 1905 505
Table 153.—Oil, essential—detailed summary, by states: 1905 506
Table 154.—Bone, ivory, and lamp black—detailed summary, United States: 1905 507
Table 155.—Chemicals—detailed summary, materials and products: 1905 507
Table 156.—Paints—detailed summary, materials and products: 1905 508
Table 157.—Fertilizers—detailed summary, materials and products: 1905 509
Table 158.—Explosives—detailed summary, materials and products: 1905 509
Table 159.—Varnishes—detailed summary, materials and products: 1905 510
Table 160.—Dyestuffs and extracts—detailed summary, materials and products: 1905 511
Table 161.—Sulphuric, nitric, and mixed acids—detailed summary, materials and products: 1905 511
Table 162.—Wood distillation—detailed summary, materials and products: 1905 512
Table 163.—Oil, essential—detailed summary, materials and products: 1905 512
COKE 515–563
Table 1.—Comparative summary, amount and per cent of increase: 1880 to 1905 515
Table 2.—Number of active establishments, by states and territories: 1880 to 1905 516
Table 3.—Capital—active and idle establishments: 1890 to 1905 516
Table 4.—Quantity and value of coal used, with per cent of increase, by states and territories: 1880 to 1905 517
Table 5.—Quantity and cost of different classes of coal used, with per cent of increase and average price per ton: 1890 to 1905 518
Table 6.—Comparative summary—relation of coal used to coke produced: 1880 to 1905 518
Table 7.—Quantity and per cent of yield of coal in coke, by states and territories: 1890 to 1905 519
Table 8.—Production of coke, by states and territories, with rank of each: 1880 to 1905 520
Table 9.—Ovens operated, quantity and value of coke, and yield of coal in coke: 1880 to 1905 521
Table 10.—Comparative summary—number and kind of ovens in active use, by states and territories: 1890 to 1905 521
Table 11.—Comparative summary—capital and ovens in idle establishments, by states and territories: 1890 to 1905 522
By-products 523, 524
Table 12.—By-products: 1905 and 1900 523
Table 13.—Actual quantity and value of all products reported in 1905, and possible quantity and value of products if total coal had been treated in by-product ovens 524
Foreign trade in coke and coke by-products 524–526
Table 14.—Imports and exports of coke: 1896 to 1905 525
Table 15.—Imports and exports of coal tar, crude and pitch: 1896 to 1905 525
Table 16.—Imports of coal tar products, not medicinal preparations, colors, or dyes: 1898 to 1905 525
Table 17.—Imports for consumption of ammonium salts: 1896 to 1905 526
Table 18.—Coke—detailed summary, by states and territories: 1905 528
Historical and descriptive 532–541
Geographic distribution 532
Process of making coke 533
Beehive ovens 533
Belgian ovens 533
By-product ovens 534
Characteristics of by-product ovens 534
Method of operating by-product ovens 535
Semet-Solvay by-product ovens 536
Semet-Solvay by-product ovens built or building in the United States, January, 1906 536
Otto-Hoffmann by-product oven 537
Otto-Hoffmann by-product coke ovens built or contracted for in the United States: 1905 537
United-Otto by-product ovens 538
Rothberg oven 538
Uses of coke 539
Table 19.—Quantity and cost of coke consumed in the iron and steel industry: 1880 to 1905 540
Uses of by-products 540

COKE—Continued. Page.
Appendix A—Bibliography ... 543
Appendix B—Digest of patents relating to coke ... 545–563
Class 202.—Charcoal and coke ... 545
Charcoal ... 545
Subclass 2.—Processes ... 545
Subclass 3.—Retorts ... 546
Subclass 10.—Kilns ... 547
Coke ... 548
Subclass 4.—Coke ovens ... 548
Subclass 5.—Chargers and dischargers ... 551
Subclass 6.—Doors ... 556
Subclass 7.—Dumping bottoms ... 557
Subclass 8.—Coke processes ... 557
Subclass 9.—Retort ovens ... 559
Illustrations: Facing page.
Location of coke plants in 1880 and 1905 ... 532
Beehive ovens at Uniontown, Pennsylvania ... 534
Coke drawer and loader for beehive ovens ... 534
Beehive ovens operated in connection with large steel plant at Pittsburg, Pennsylvania ... 536
Longitudinal cross section of five high Semet-Solvay ovens ... (page) .. 537
Sectional view of Otto-Hoffmann oven ... 538
Section of United-Otto plan ... 538
Semet-Solvay ovens at Dunbar, Pennsylvania ... 538
Semet-Solvay ovens at Wheeling, West Virginia ... 538
General view of plant at Everett, Massachusetts ... 540
Sectional view of condensing apparatus ... 540
Latest installation of 100 ovens of steel plant at Johnstown, Pennsylvania ... 540
Quencher in operation ... 540
Page.
PETROLEUM REFINING ... 567–615
Table 1.—Comparative summary, with amount and per cent of increase: 1880 to 1905 ... 567
Table 2.—Number of active refineries, by states: 1880 to 1905 ... 567
Table 3.—Capital, with amount and per cent of increase: 1890 to 1905 ... 568
Table 4.—Per cent distribution of capital: 1890 to 1905 ... 568
Table 5.—Materials used, with amount and per cent of increase: 1880 to 1905 ... 569
Table 6.—Equipment of plant, by states: 1890 to 1905 ... 570
Table 7.—Products, by kind, quantity, and value: 1880 to 1905 ... 570
Table 8.—Products, with amount and per cent of increase in quantity and value: 1880 to 1905 ... 571
Table 9.—Per cent distribution of crude petroleum among the several products: 1880 to 1905 ... 571
Table 10.—Per cent distribution of the value of products: 1880 to 1905 ... 571
Table 11.—Production of crude petroleum, and exports of crude and refined oils, from 1889 to 1904, and for 1880 ... 573
Table 12.—Imports of mineral oils and paraffin: 1901 to 1905 ... 574
Table 13.—Petroleum refining—detailed summary, by states: 1905 ... 574
Historical and descriptive ... 576–583
Appendix A—Bibliography ... 585
Appendix B—Digest of patents relating to petroleum refining ... 587–615
Class 196.—Mineral oils ... 587–615
Subclass 1.—Apparatus ... 587
Subclass 2.—Reducing gravity ... 587
Subclass 3.—Stills ... 588
Subclass 4.—Stirrers and scrapers ... 590
Subclass 5.—Condensers ... 590
Subclass 6.—Bottoms ... 593
Subclass 7.—Feeders ... 593
Subclass 8.—Films ... 594
Subclass 9.—Furnaces and flues ... 594
Subclass 10.—Heads ... 595
Subclass 11.—Apparatus—stills and jackets ... 596
Subclass 12.—Rotary ... 596
Subclass 13.—Series ... 597
Subclass 14.—Tubulars ... 598
Subclass 15.—Utilizing gases and residue ... 599
Subclass 16.—Vacuum ... 599
Subclass 17.—Vapor outlets ... 599
Subclass 18.—Supplementary heating ... 599

PETROLEUM REFINING—Continued.
Appendix B—Digest of patents relating to petroleum refining—Continued.
Class 196.—Mineral oils—Continued.
Coal oil: Page.
Subclass 19.—Retorts 600
Subclass 20.—Rotary 600
Subclass 21.—Processes 601
Subclass 22.—Compositions 601
Subclass 23.—Burning fluid 602
Subclass 24.—Paraffin 603
Subclass 25.—Processes 604
Subclass 26.—Chemical 606
Subclass 27.—Injecting gases 612
Subclass 28.—Residuum 613
Subclass 29.—Washing and filtering 614
Class 73.—Measuring instruments 615
Subclass 50.—Fluids 615
Illustrations: Facing page.
Storage tanks for petroleum 576
Stills for crude petroleum 578
Bird's-eye view of Eclipse Works 578
Refinery, Whiting, Ind 582
Page.
POWER EMPLOYED IN MANUFACTURES 619–639
Table 1.—Comparative summary, with per cent of increase: 1870 to 1905 619
Table 2.—Power in idle establishments: 1905 and 1900 620
Power in selected industries 620–625
Table 3.—Power, by kind, in selected industries, with per cent distribution of total horsepower: 1880 to 1905 621
Table 4.—Power, by kind, in selected industries, with amount and per cent of increase: 1870 to 1905 622
Table 5.—Power in selected industries, with per cent of increase; horsepower per wage-earner; and horsepower per $1,000 of products: 1870 to 1905 624
Geographic distribution of power 625, 626
Table 6.—Power, by kind, with per cent distribution of total horsepower, by geographic divisions: 1870 to 1905 625
Steampower 626–629
Table 7.—Steampower, with amount and per cent of increase, by states and territories: 1870 to 1905 627
Waterpower 629–631
Table 8.—Waterpower, with amount and per cent of increase, by states and territories: 1870 to 1905 630
Electric power 631–635
Table 9.—Electric power, with amount and per cent of increase, by states and territories: 1890 to 1905 632
Electrical transmission plants 634
Gas engine power 635–638
Table 10.—Gas and gasoline power, with amount and per cent of increase, by states and territories: 1890 to 1905 636
Other power 638
Rented power 638, 639
Table 11.—Rented power, by states and territories: 1890 to 1905 638
EARNINGS OF WAGE-EARNERS 643–813
Summary of results 643–648
Scope of the inquiry 643
Form of the inquiry 643
Representative character of data 644
Table 1.—Average number of wage-earners employed during the year by establishments included in statistics of weekly earnings, and number of wage-earners reported for the week covered by these statistics, compared with the average number employed during the year by all establishments: 1905 644
General results 645
Table 2.—United States—summary of all wage-earners, and men, women, and children, by classified weekly earnings, with percentage at each amount: 1905 645
Table 3.—Women and children in groups of highest weekly earnings, by states: 1905 646
Table 4.—Estimated distribution by weekly earnings of average number of all wage-earners, and men, women, and children: 1905 647
Industries 648–653
Table 5.—Industries reporting the highest and the lowest average weekly earnings for men, women, and children: 1905 649
Table 6.—Twenty-five selected industries—per cent which number and earnings of men, women, and children form of number and earnings in all industries included in classified weekly earnings: 1905 650
Table 7.—Median groups and average weekly earnings, all wage-earners and men, women, and children in twenty-five selected industries: 1905 651
Proportional numbers and earnings 652
Table 8.—Proportional numbers and earnings, men, women, and children, in twenty-five selected industries: 1905 652

EARNINGS OF WAGE-EARNERS—Continued. Page.
Analysis of selected industries ... 654–669
Boots and shoes ... 654–656
Table 9.—Boots and shoes—all establishments and greatest number of wage-earners, compared with number of establishments and wage-earners selected for classified earnings, by states, territories, and geographic divisions: 1905 ... 654
Table 10.—Boots and shoes—number and per cent distribution of wage-earners for the United States, and for Massachusetts; and of wage-earners—men, women, and children—by classified weekly earnings for the United States, exclusive of Massachusetts: 1905 ... 655
Table 11.—Boots and shoes—per cent distribution of men, women, and children, by states, territories, and geographic divisions: 1905 ... 656
Cotton goods ... 656–659
Table 12.—Cotton goods—all establishments and greatest number of wage-earners, compared with number of establishments and wage-earners, selected for classified earnings, by states and geographic divisions: 1905 ... 656
Table 13.—Comparison of classified earnings in selected establishments manufacturing cotton yarns and plain cloths for printing and converting, in New England and the Southern states: 1905 ... 658
Glass ... 659–662
Table 14.—Glass—all establishments and greatest number of wage-earners, compared with number of establishments and wage-earners, selected for classified earnings, by states and geographic divisions: 1905 ... 660
Table 15.—Glass—per cent distribution of men, women, and children, by states and geographic divisions: 1905 ... 660
Table 16.—Glass—average weekly earnings and per cent distribution of wage-earners—men, women, and children—by classified weekly earnings, and by class of products: 1905 ... 662
Iron and steel, blast furnaces ... 662–666
Table 17.—Iron and steel, blast furnaces—all establishments and greatest number of wage-earners, compared with number of establishments and wage-earners, selected for classified earnings, by states and geographic divisions: 1905 ... 663
Tobacco, cigars and cigarettes ... 666–669
Table 18.—Tobacco, cigars and cigarettes—all establishments and greatest number of wage-earners, compared with number of establishments and wage-earners, selected for classified earnings, by states, territories, and geographic divisions: 1905 ... 666
Table 19.—Tobacco, cigars and cigarettes—per cent distribution of wage-earners—men, women, and children—by geographic divisions: 1905 ... 667
Table 20.—Tobacco, cigars and cigarettes—per cent distribution by class, of number and earnings of wage-earners in each geographic division: 1905 ... 667
Table 21.—Tobacco, cigars and cigarettes—number and earnings of men and women employed as wage-earners, in selected establishments, for states in which women are in excess of men: 1905 ... 667
Table 22.—Tobacco, cigars and cigarettes—earnings of men and women in states grouped according to the proportion of women to men: 1905 ... 668
Table 23.—Tobacco, cigars and cigarettes—median groups and average earnings of wage-earners—men, women, and children—in states in which women are in excess of men: 1905 ... 668
States, territories, and geographic divisions ... 669–707
Classified weekly earnings ... 669
Table 24.—Median groups and average weekly earnings, all wage-earners and men, women, and children, by states, territories, and geographic divisions: 1905 ... 670
Rank by average weekly earnings ... 672
Table 25.—Rank of geographic divisions, states, and territories with respect to average weekly earnings: 1905 ... 672
Comparison between Western and Southern states ... 677
Table 26.—Highest and lowest average earnings—twelve states compared: 1905 ... 677
Table 27.—Earnings of men employed in the manufacture of lumber and timber products in selected states of the Western and South Atlantic divisions: 1905 ... 678
Proportional numbers and earnings ... 679
Table 28.—Proportional numbers and earnings—men, women, and children—by states, territories, and geographic divisions: 1905 ... 679
Geographic divisions ... 680–707
New England division ... 680–683
Table 29.—New England division—number and per cent of establishments and wage-earners included in weekly earnings, by states: 1905 ... 680
Table 30.—New England division—number and per cent of wage-earners at each amount of classified earnings, by states: 1905 ... 681
Table 31.—New England division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905 ... 681
Southern North Atlantic division ... 683–685
Table 32.—Southern North Atlantic division—number and per cent of establishments and wage-earners included in weekly earnings, by states: 1905 ... 683
Table 33.—Southern North Atlantic division—number and per cent of wage-earners at each amount of classified earnings, by states: 1905 ... 684
Table 34.—Southern North Atlantic division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905 ... 684

EARNINGS OF WAGE-EARNERS—Continued. Page.
States, territories, and geographic divisions—Continued.
Geographic divisions—Continued.
Northern South Atlantic division 685–688
Table 35.—Northern South Atlantic division—number and per cent of establishments and wage-earners included in weekly earnings, by states: 1905 686
Table 36.—Northern South Atlantic division—number and per cent of wage-earners at each amount of classified earnings, by states: 1905 686
Table 37.—Northern South Atlantic division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905 687
Southern South Atlantic division 688–690
Table 38.—Southern South Atlantic division—number and per cent of establishments and wage-earners included in weekly earnings, by states: 1905 688
Table 39.—Southern South Atlantic division—number and per cent of wage-earners at each amount of classified earnings, by states: 1905 688
Table 40.—Southern South Atlantic division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905 689
Eastern North Central division 690–693
Table 41.—Eastern North Central division—number and per cent of establishments and wage-earners included in weekly earnings, by states: 1905 691
Table 42.—Eastern North Central division—number and per cent of wage-earners at each amount of classified earnings, by states: 1905 691
Table 43.—Eastern North Central division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905 692
Western North Central division 693–697
Table 44.—Western North Central division—number and per cent of establishments and wage-earners included in weekly earnings, by states: 1905 694
Table 45.—Western North Central division—number and per cent of wage-earners at each amount of classified earnings, by states: 1905 694
Table 46.—Western North Central division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905 695
Eastern South Central division 697–699
Table 47.—Eastern South Central division—number and per cent of establishments and wage-earners included in weekly earnings, by states: 1905 697
Table 48.—Eastern South Central division—number and per cent of wage-earners at each amount of classified earnings, by states: 1905 697
Table 49.—Eastern South Central division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905 698
Western South Central division 699–701
Table 50.—Western South Central division—number and per cent of establishments and wage-earners included in weekly earnings, by states and territories: 1905 699
Table 51.—Western South Central division—number and per cent of wage-earners at each amount of classified earnings, by states and territories: 1905 700
Table 52.—Western South Central division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states and territories: 1905 701
Rocky Mountain division 701–703
Table 53.—Rocky Mountain division—number and per cent of establishments and wage-earners included in weekly earnings, by states and territories: 1905 702
Table 54.—Rocky Mountain division—number and per cent of wage-earners at each amount of classified earnings, by states and territories: 1905 702
Table 55.—Rocky Mountain division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states and territories: 1905 703
Basin and Plateau division 703–705
Table 56.—Basin and Plateau division—number and per cent of establishments and wage-earners included in weekly earnings, by states and territories: 1905 704
Table 57.—Basin and Plateau division—number and per cent of wage-earners at each amount of classified earnings, by states and territories: 1905 704
Table 58.—Basin and Plateau division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states and territories: 1905 704
Pacific division 705–707
Table 59.—Pacific division—number and per cent of establishments and wage-earners included in weekly earnings, by states. 1905 705
Table 60.—Pacific division—number and per cent of wage-earners at each amount of classified earnings, by states: 1905 705
Table 61.—Pacific division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905 706
Alaska 707

EARNINGS OF WAGE-EARNERS—Continued. Page.

Large and small establishments ... 707–715

Table 62.—United States—number of wage-earners—men, women, and children—and amount of their earnings, classified according to size of establishment, with per cent distribution: 1905 ... 707

Table 63.—United States—average weekly earnings of all wage-earners, and of men, women, and children, in large and small establishments: 1905 ... 708

Table 64.—Rhode Island—average weekly earnings for selected industries: 1905 ... 708

Table 65.—United States—number and per cent distribution of wage-earners—men, women, and children—by classified weekly earnings and size of establishment: 1905 ... 709

Table 66.—Five selected industries—number and per cent distribution of wage-earners—men, women, and children—in establishments according to size, by geographic divisions and classified weekly earnings: 1905 ... 710

Table 67.—Classified weekly earnings—United States, by specified industries—number of wage-earners—men, women, and children—in each group of earnings, with earnings and number of all wage-earners and of each class, average number of men, women, and children employed during the year, and number of establishments: 1905 ... 716

Table 68.—Classified weekly earnings—United States, by specified industries—per cent distribution of wage-earners—men, women, and children—with average weekly earnings of all wage-earners, and of each class, number of establishments, and per cent number of all wage-earners in the statistics forms of greatest number, all establishments: 1905 ... 732

Table 69.—Classified weekly earnings—United States, by states, territories, and geographic divisions—number of wage-earners—men, women, and children—in each group of earnings, with earnings and number of all wage-earners and of each class, average number of men, women, and children employed during the year, and number of establishments: 1905 ... 742

Table 70.—Classified weekly earnings—United States, by states, territories, and geographic divisions—per cent distribution of wage-earners—men, women, and children—with number of establishments: 1905 ... 746

Table 71.—Classified weekly earnings—twenty-five selected industries, by states, territories, and geographic divisions—per cent distribution of wage-earners—men, women, and children—by groups of earnings; total and average weekly earnings, and number of all wage-earners and of each class; with number of establishments: 1905 ... 748

Table 72.—Classified weekly earnings—twenty-five states, by selected industries—per cent distribution of wage-earners—men, women, and children—by groups of earnings; total and average weekly earnings, and number of all wage-earners and of each class; with number of establishments: 1905 ... 774

Appendix:

Classified weekly earnings, 1905, and wage statistics of prior censuses ... 793–813

Statistics for 1904 not strictly comparable with prior censuses ... 793

Comparison of rates and earnings ... 793–796

Table 1.—Summary of statistics for classified weekly earnings, 1905, and weekly rates, 1900, for men in thirty-four industries ... 794

Table 2.—Classified weekly earnings, 1905, and weekly rates, 1900 total, for men—absolute number in each group by industries: 1905 and 1900 ... 794

Industry classifications adjusted: 1900 and 1905 ... 795

Comparison of earnings by industries ... 797–801

Table 3.—Agricultural implements—number of men by classified weekly earnings, with cumulative percentages, and estimated distribution of average number in all establishments: 1890 to 1905 ... 797

Table 4.—Carpet mills—number of men and women by classified weekly earnings, with cumulative percentages, and estimated distribution of average number in all establishments: 1890 to 1905 ... 797

Table 5.—Cars and railroad shops—number of men by classified weekly earnings, with cumulative percentages, and estimated distribution of average number in all establishments: 1890 to 1905 ... 798

Table 6.—Cigars—number of men and women by classified weekly earnings, with cumulative percentages, and estimated distribution of average number in all establishments: 1890 to 1905 ... 798

Table 7.—Clothing—number of women by classified weekly earnings, with cumulative percentages, and estimated distribution of average number in all establishments: 1890 to 1905 ... 798

Table 8.—Collars and cuffs—number of men, women, and children by classified weekly earnings, with cumulative percentages, and estimated distribution of average number in all establishments: 1890 to 1905 ... 799

Table 9.—Cotton mills—number of men and women by classified weekly earnings, with cumulative percentages, and estimated distribution of average number in all establishments: 1890 to 1905 ... 799

Table 10.—Knitting mills—number of men, women, and children by classified weekly earnings, with cumulative percentages, and estimated distribution of average number in all establishments: 1890 to 1905 ... 800

Table 11.—Shoes—number of men and women by classified weekly earnings, with cumulative percentages, and estimated distribution of average number in all establishments: 1890 to 1905 ... 800

Table 12.—Tanneries—number of men by classified weekly earnings, with cumulative percentages, and estimated distribution of average number in all establishments: 1890 to 1905 ... 801

Table 13.—Wagons—number of men by classified weekly earnings, with cumulative percentages, and estimated distribution of average number in all establishments: 1890 to 1905 ... 801

Comparison of earnings in same establishments ... 801–813

Wage-earners in 25 establishments, 1905, 1900, and 1890; with percentage in establishments showing increased earnings: 1905 and 1900 ... 813

Diagrams:

Diagram 1.—Classified weekly earnings—number of all wage-earners, by groups of earnings: 1905 ... 646

Diagram 2.—Classified weekly earnings, twenty-five selected industries—per cent that average earnings of all wage-earners, and of men, women, and children are above or below average for United States: 1905 ... 653

EARNINGS OF WAGE-EARNERS—Continued. Page.
Diagrams—Continued.
Diagram 3.—Classified weekly earnings, boots and shoes—per cent that average earnings of all wage-earners, and of men, women, and children are above or below average for the United States, by geographic divisions: 1905 655
Diagram 4.—Classified weekly earnings, cotton goods—per cent that average earnings of all wage-earners, and of men, women, and children are above or below average for the United States, by geographic divisions: 1905 ... 657
Diagram 5.—Classified weekly earnings, glass—per cent that average earnings of all wage-earners, and of men, women, and children are above or below average for the United States, by geographic divisions: 1905 661
Diagram 6.—Classified weekly earnings, iron and steel, blast furnaces—per cent that average earnings of all wage-earners, and of men, women, and children are above or below the average for the United States, by geographic divisions: 1905 664
Diagram 7.—Classified weekly earnings, tobacco, cigars and cigarettes—per cent that average earnings of all wage-earners, and of men, women, and children are above or below average for the United States, by geographic divisions: 1905 669
Diagram 8.—Classified weekly earnings—per cent distribution of number of men by groups of earnings in geographic divisions: 1905 671
Diagram 9.—Classified weekly earnings—per cent distribution of number of women by groups of earnings in geographic divisions: 1905 671
Diagram 10.—Classified weekly earnings—per cent distribution of number of children by groups of earnings in geographic divisions: 1905 671
Diagram 11.—Classified weekly earnings—average weekly earnings of all wage-earners, and of men, women, and children, by geographic divisions: 1905 674
Diagram 12.—Classified weekly earnings—per cent that average earnings of all wage-earners, and of men, women, and children are above or below average for the United States, by geographic divisions: 1905 675
Diagram 13.—Classified weekly earnings—per cent that average earnings of all wage-earners, and of men, women, and children are above or below average for the United States, by states and territories: 1905 676
Diagram 14.—Classified weekly earnings—number and earnings of men, women, and children, by geographic divisions: 1905. 680
Maps:
Map 1.—Average weekly earnings—all wage-earners, by states and territories: 1905 672
Map 2.—Average weekly earnings—men 16 years and over, by states and territories: 1905 672
Map 3.—Average weekly earnings—women 16 years and over, by states and territories: 1905 673
Map 4.—Average weekly earnings—children under 16 years, by states and territories: 1905 673

LETTER OF TRANSMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF THE CENSUS,
Washington, D. C., May 14, 1908.

SIR:

I have the honor to transmit herewith Part IV of the Report on Manufactures for the census of 1905. This census was taken in conformity with the act of Congress of March 6, 1902, and the statistics cover the calendar year ending December 31, 1904.

This volume is a compilation of the bulletins for a number of the leading industries of the United States, which were published as rapidly as the compilation of the data was finished. The monographs are bound together, because it is the only way they can be permanently preserved and made convenient for general reference. The statistics contained in these reports are combined with those for all other industries, thus giving the totals for all branches of manufactures in the United States and in each state and territory, which are published in Parts I and II of the census of 1905. The fieldwork, the compilation of the statistics, and the preparation of the text have been done by the regular force of the Office, working under the supervision of Mr. William M. Steuart, chief statistician for manufactures.

Very respectfully,

S. N. D. North
Director.

HON. OSCAR S. STRAUS,
Secretary of Commerce and Labor.

IRON AND STEEL

IRON AND STEEL.

By Story B. Ladd.

This report presents the statistics of the iron and steel industry for the census of manufactures of 1905. The period covered is the calendar year 1904, or the business year of the establishment reporting which most nearly conforms to this, and ends before January 1, 1905.

In drawing comparisons between the figures of the different censuses it should be borne in mind that the interval between the present census and that of 1900 is but one-half of that for prior census periods.

It should also be specially noted that the iron and steel industry in 1904 was seriously affected by the general business depression which began in the first half of 1903 and continued until August and September, 1904. The iron and steel production during the year 1904 was in many lines less than in 1903 and 1902, the increased production resulting from the revival in the fall of the year not being sufficient to offset the losses during the earlier months. On the other hand, each of the prior censuses from 1870 to 1900, inclusive, which is presented in this report in comparison with 1905, was for a year of industrial activity and prosperity, a year of advancement and growth. The census of 1870 was taken for a year of increasing production, the crest of which, measured by pig iron production, was reached in 1873; the crest of the wave of increase of 1880 was reached in 1883; 1890 was at the summit of a period of business activity and growth; and the period of increasing production witnessed in 1900 did not receive a check until 1903. Likewise, the iron and steel production for the calendar year 1905 was abnormally and phenomenally large and the industry uniformly prosperous. The Census report therefore presents under cover of 1905, which was an active and prosperous year, the statistics for a year of partial depression and curtailment, in comparison with prior census years of growth and prosperity.

The statistics relate only to establishments which operate blast furnaces, steel works and rolling mills, and forges and bloomeries. Establishments manufacturing iron blooms, billets, and hammered bar iron direct from iron ore or from pig iron, scrap iron, or steel are classified as forges and bloomeries only when the products are made for sale and not for consumption in a rolling mill department of the producing plant. In the early years of the iron and steel industry the forges and bloomeries were an important feature, but they have been steadily declining, and at the census of 1905 the few remaining bloomeries are included in the statistics for steel works and rolling mills except when shown separately for comparative purposes with former years.

The blast furnace products include all kinds of pig iron, spiegeleisen, ferromanganese, and ferrosilicon, whether cast or used in a molten condition in Bessemer converters, open-hearth furnaces, cupolas, etc., and castings made direct from the furnace. The products of steel works and rolling mills embrace steel ingots and direct steel castings and all hot rolled or forged iron or steel. Many mills carry the manufacture of the primary rolling mill products through to more highly finished forms, such as nails, spikes, bolts, nuts, and wire, and in some cases products of this kind constitute the bulk of the output of the establishment. In such cases the statistics presented are those of the primary rolling mill products, the enhanced value due to the further manufacture into more highly finished forms being handled as a separate factor. The gross ton (2,240 pounds) is used throughout the report except for coke, which is in short tons (2,000 pounds).

At the census of 1880 the capital and labor employed in mining iron ore and coal, in coke making, quarrying limestone, charcoal burning, etc., were included in the capital invested and labor employed in the production of pig iron where the mines, ovens, quarries, or kilns were owned or operated by the blast furnace establishments. The cost of materials reported was nevertheless, apparently, the cost at the furnace, and hence the figures of cost for 1880 involve a duplication to this extent. The statistics for 1890, 1900, and 1905 for the blast furnace industry relate only to the manufacture of pig iron, and do not, as a rule, include details for any of these related industries.

The industry is discussed under the following heads:

The iron and steel industry as a whole.
The electrothermic metallurgy of iron and steel.
Blast furnaces.
Steel works and rolling mills.
Forges and bloomeries.

THE IRON AND STEEL INDUSTRY.

Table 1 shows the general statistics for the iron and steel industry as a whole for the census years 1870 to 1905, with the percentage of increase or decrease for each period. In 1870 active establishments were not separated from idle, but for each of the later years only active establishments are included.

TABLE 1.—IRON AND STEEL—COMPARATIVE SUMMARY, WITH PER CENT OF INCREASE: 1870 TO 1905.

	CENSUS.					PER CENT OF INCREASE.			
	1905[1]	1900	1890	1880	1870	1900 to 1905	1890 to 1900	1880 to 1890	1870 to 1880
Number of establishments	[2] 606	[2] 669	719	792	[3] 808	[4] 9.4	[4] 7.0	[4] 9.2	[4] 2.0
Capital	[5] $948,689,840	[5] $590,530,484	[5] $414,044,844	$209,904,965	$121,772,074	60.7	42.6	97.3	72.4
Salaried officials, clerks, etc., number	16,566	9,217	[6] 4,325	(7)	(7)	79.7	113.1	......	......
Salaries	$20,758,412	$11,741,788	[6] $6,462,236	(7)	(7)	76.8	81.7	......	......
Wage-earners, average number	242,740	222,607	171,181	140,798	77,555	9.0	30.0	21.6	81.5
Total wages	$141,439,906	$120,836,338	$89,273,956	$55,451,510	$40,514,981	17.1	35.4	61.0	36.9
Men 16 years and over	239,383	219,635	168,943	133,023	75,037	9.0	30.0	27.0	77.3
Wages	$140,545,610	$120,157,007	$88,840,642	(7)	(7)	17.0	35.3	......	......
Women 16 years and over	1,455	1,071	58	45	82	35.9	1,746.6	28.9	45.1
Wages	$441,967	$266,888	$17,106	(7)	(7)	65.6	1,460.2	......	......
Children under 16 years	1,902	1,901	2,180	7,730	2,436	0.1	[4] 12.8	[4] 71.8	217.3
Wages	$452,329	$412,443	$416,208	(7)	(7)	9.7	[4] 0.9	......	......
Miscellaneous expenses	$47,164,970	$32,274,100	$18,214,948	(8)	(8)	46.1	77.2	......	......
Cost of materials used	$620,171,881	$522,431,701	$327,272,845	$191,271,150	$135,526,132	18.7	59.6	71.1	41.1
Value of products [9]	$905,854,152	$804,034,918	$478,687,519	$296,557,685	$207,208,696	12.7	68.0	61.4	43.1
Tons of product [10]	34,844,933	29,507,860	16,264,478	6,486,733	3,263,585	18.1	81.4	150.7	98.8

1 Exclusive of the statistics of 6 establishments engaged primarily in the manufacture of other products. These establishments made 4,184 tons of steel castings, valued at $347,264.
2 Includes 1 penal institution, the statistics for which are not included in the detailed summary.
3 Includes idle establishments which were not reported separately in 1870.
4 Decrease.
5 Includes value of rented property—1905, $12,106,619; 1900, $16,968,821; 1890, $8,273,058.
6 Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905, but not included in this table.
7 Not reported separately.
8 Not reported.
9 Includes value of miscellaneous products for which tonnage was not reported.
10 Gross tons of 2,240 pounds.

In 1870 the United States had a population of 38,558,371, and the iron and steel industry a product of 3,263,585 tons, or an average of 0.0846 of a ton of product per unit of population. In 1880 the iron and steel tonnage per unit of population had increased to 0.1293 of a ton; in 1890 it was 0.2584 of a ton; in 1900, 0.3883 of a ton; and in 1904, on the basis of the estimate of population of continental United States, it was 0.4288 of a ton. Thus the iron and steel industry not only keeps pace with the growth in population, but shows an increase per unit of population during the decade of 1870 to 1880 of 52.8 per cent; for the decade ending in 1890, of 99.8 per cent; for the decade ending in 1900, of 50.3 per cent; and for the five years 1900 to 1905, of 10.7 per cent.

The number of establishments has steadily decreased at each succeeding census, falling from 808 in 1870 to 606 in 1905, while the capital invested has increased nearly sevenfold and the value of products more than threefold. This shows strikingly the concentration that has marked the development of the industry during this period of thirty-five years. To a small extent the decrease in number of establishments in 1905, as compared with 1900, is due to the fact that in a few cases one report was made for two or more plants under the same ownership and within the same municipality, whereas in 1900 separate reports were made for the different plants.

It will be noted that the increase in capital is apparently out of proportion to the growth of the industry in other particulars. The reported capital invested in 1905 exceeds that of 1900 by $358,159,356, or 60.7 per cent; whereas the increase in wage-earners, wages paid, cost of materials, and value and quantity of products all fall within a range of from 9 to 19 per cent. This difference is in part explained by the depression in the iron and steel industry prevailing during the early part of the census year, which restricted production, labor, and operating expense. The capital invested in 1870 shows an average per ton of product of $37.31; in 1880 it was $32.36; in 1890, $25.46; and in 1900, $20.01. At the present census the invested capital as reported shows an average of $27.23 per ton of product. Manifestly, if the law of progress deduced from these returns holds true—namely, a steady advance in the earning power of capital from decade to decade through the use of improved appliances and methods—the capital invested per ton of product should, with full production, be less than that of former years, whereas it exceeds that of 1900 and 1890. The large increase in capital is due in part to the fact that, in the case of some of the corporations, the capital reported as invested in land, buildings, machinery, etc., and live capital, is stock capital as carried on their books, this being the only thing possible to report under the circumstances. But in the case of a corporation formed by the aggregation of a number of plants which have been turned over to the new company for stock considerations, such book accounts necessarily represent more than actual cash investments.

Attention is called to the fact that the number of children employed is substantially the same as in 1900 (except by one) and has not increased with the growth of this industry. In 1890 the average number of children under 16 years employed was 1.3 per cent of all wage-earners; in 1900 they constituted nine-tenths of 1 per cent; and in 1905 they formed eight-tenths of 1 per cent. The 1880 and 1870 figures include children

employed in coal mining, etc., in conjunction with blast furnace operations, and hence are not comparable.

Table 2 shows the leading statistics of the iron and steel industry for 1905, by states, in comparison with like statistics of the states or territories for 1880, 1890, and 1900. In the census years of 1900 and 1905 there were no territories which produced pig iron, steel, or rolling mill products.

As these statistics are the combined statistics for blast furnace establishments and steel works and rolling mills, which are separately considered in later tables, it is necessary to group under "all other states" such states as have establishments owned by less than three organizations in either branch of the industry, in order that the operations of individual establishments may not be deducible by comparison of the different tables.

TABLE 2.—IRON AND STEEL—COMPARATIVE SUMMARY, BY STATES: 1880 TO 1905.

STATE.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
				Number.	Salaries.	Average number.	Wages.			
United States	1905	606	[1]$948,689,840	16,566	$20,758,412	242,740	$141,439,906	$47,164,970	$620,171,881	[2]$905,854,152
	1900	669	[1]590,530,484	9,217	11,741,788	222,607	120,836,338	32,274,100	522,431,701	804,034,918
	1890	719	[1]414,044,844	[3]4,325	[3]6,462,236	171,181	89,273,956	18,214,948	327,272,845	478,687,519
	1880	792	209,904,965	(4)	(4)	140,798	55,451,510	(5)	191,271,150	296,557,685
Alabama	1905	29	29,153,289	427	543,954	8,590	3,447,889	789,989	16,047,423	24,687,359
	1900	25	16,091,479	182	292,861	7,238	2,454,401	896,126	10,062,094	17,392,483
	1890	35	17,987,583	193	319,044	5,685	2,202,964	1,089,690	7,425,344	12,544,227
	1880	8	2,757,196			1,626	571,713		601,073	1,452,856
California	1905	4	1,110,192	35	53,073	773	492,390	84,933	778,970	1,489,012
	1900	3	1,499,162	18	22,250	555	327,184	18,944	506,834	900,854
	1890	4	4,656,611	38	56,549	1,114	693,300	208,088	1,938,333	3,097,155
	1880	1	1,000,000			319	177,722		535,500	780,000
Connecticut [6]	1890	13	2,189,521	41	55,784	649	362,405	96,123	1,324,078	2,037,618
	1880	17	2,557,000			685	331,184		1,341,225	1,998,698
Delaware	1905	5	6,279,585	91	102,952	1,055	412,003	144,785	939,506	1,597,309
	1900	6	4,207,079	81	132,677	1,490	705,366	140,054	1,635,762	3,159,641
	1890	7	2,558,865	53	78,061	1,637	765,158	43,201	1,549,539	2,608,670
	1880	8	1,341,469			867	344,476		1,214,050	2,347,177
Georgia [7]	1900	3	666,916	18	13,295	194	48,391	8,300	237,421	391,599
	1890	5	908,243	18	23,125	339	89,045	52,770	321,728	471,757
	1880	9	973,800			1,303	185,489		631,707	990,850
Illinois	1905	27	58,595,150	1,350	1,785,118	18,358	11,468,957	4,340,951	57,655,185	87,352,761
	1900	26	43,356,239	780	926,091	16,642	9,640,716	3,208,240	41,729,261	60,303,144
	1890	24	34,689,919	179	269,308	8,685	5,220,883	793,128	30,039,674	39,011,051
	1880	16	5,795,620			5,253	2,508,718		14,977,145	20,545,289
Indiana	1905	21	22,985,691	323	369,962	7,215	4,071,593	606,398	10,905,822	16,920,326
	1900	27	14,994,210	205	266,764	7,579	4,243,831	376,844	12,438,754	19,338,481
	1890	15	4,099,095	69	103,013	2,648	1,151,148	171,548	3,075,056	4,742,760
	1880	12	2,283,000			2,048	864,921		3,293,073	4,551,403
Kentucky [6]	1890	9	2,310,655	48	63,689	1,435	670,489	115,645	1,703,144	2,725,603
	1880	18	4,610,035			4,095	1,344,400		3,223,799	5,090,029
Maryland [7]	1900	9	3,765,003	55	77,147	2,138	1,029,753	508,298	6,888,916	8,739,405
	1890	10	4,217,574	25	24,358	1,247	371,993	46,077	2,217,173	2,869,208
	1880	18	4,402,125			2,763	905,090		2,888,574	4,470,050
Massachusetts [6]	1890	15	9,005,555	127	182,964	5,210	2,469,075	208,262	6,951,018	11,201,149
	1880	24	6,163,408			6,513	2,576,539		6,657,232	10,288,921
Michigan	1905	16	6,080,677	135	155,700	2,157	1,114,289	366,760	4,904,315	7,355,652
	1900	10	3,934,050	72	95,076	1,972	941,091	277,827	3,770,213	5,902,058
	1890	19	6,696,541	82	139,756	1,427	756,361	369,163	4,135,991	5,829,843
	1880	15	3,342,386			3,089	922,597		3,279,420	4,591,613
Missouri [6]	1890	9	3,495,913	45	65,802	1,269	655,099	175,924	2,079,254	3,237,542
	1880	12	5,698,600			3,139	734,575		3,249,558	4,660,530
New Jersey	1905	21	51,794,677	598	848,487	9,108	4,458,728	1,639,915	15,330,455	23,667,483
	1900	25	20,336,609	332	497,245	8,288	3,892,941	1,146,984	16,310,425	24,381,699
	1890	28	11,697,362	146	238,183	5,150	2,546,791	639,351	7,031,046	11,018,575
	1880	37	8,764,050			4,792	1,808,448		6,556,283	10,341,896
New York	1905	29	64,041,775	685	958,482	9,085	5,554,401	1,445,398	19,633,602	29,862,136
	1900	30	13,292,346	238	377,988	5,418	3,062,711	503,558	7,676,155	13,858,553
	1890	44	16,282,435	186	301,843	6,848	3,303,811	877,541	10,424,852	15,849,537
	1880	74	19,752,471			11,444	4,099,451		13,395,229	22,219,219
Ohio	1905	90	131,262,446	2,139	2,499,295	33,190	22,128,625	5,925,771	110,686,497	152,859,124
	1900	107	86,477,552	1,231	1,592,501	33,677	19,730,469	4,400,859	91,329,307	138,935,256
	1890	101	37,642,887	620	864,528	23,546	13,262,141	2,293,068	44,551,301	65,206,828
	1880	103	22,807,606			20,071	8,265,070		23,997,915	34,918,360

[1] Includes value of rented property—1905, $12,106,619; 1900, $16,968,821; 1890, $8,273,058.
[2] Exclusive of steel castings to the value of $347,264, made by establishments engaged primarily in the manufacture of other products.
[3] Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905, but not included in this table.
[4] Not reported separately.
[5] Not reported.
[6] Included in "all other states", in 1900 and 1905.
[7] Included in "all other states" in 1905.

TABLE 2.—IRON AND STEEL—COMPARATIVE SUMMARY, BY STATES: 1880 TO 1905—Continued.

STATE.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
				Number.	Salaries.	Average number.	Wages.			
Pennsylvania	1905	251	472,547,945	9,020	11,171,732	124,771	73,070,358	26,504,604	324,196,900	471,228,844
	1900	291	321,985,659	5,068	6,184,780	110,864	61,908,405	17,845,789	283,142,785	434,445,200
	1890	311	226,294,407	2,099	3,129,515	92,473	49,550,665	9,764,737	180,220,237	264,571,624
	1880	321	102,956,223	...	...	57,952	25,095,850	...	92,267,030	145,576,268
Tennessee[1]	1900	16	5,432,665	96	118,244	1,979	539,304	226,365	3,404,154	5,080,624
	1890	15	4,613,355	85	118,446	1,472	657,075	276,869	2,943,671	4,247,868
	1880	29	2,862,826	...	...	3,077	659,773	...	1,376,059	2,274,203
Texas[2]	1900	3	379,215	14	9,160	248	42,661	8,229	90,439	172,468
	1880	1	40,000	...	...	140	27,720	...	23,580	36,000
Virginia	1905	13	5,279,954	106	148,671	2,103	728,186	285,734	3,538,839	4,859,386
	1900	20	6,941,696	150	208,669	3,097	980,587	248,314	5,498,672	8,341,888
	1890	21	6,330,993	100	145,908	3,010	1,117,452	373,749	4,404,452	6,326,084
	1880	21	2,294,713	...	...	2,522	665,432	...	1,496,151	2,585,999
West Virginia[1]	1900	11	8,202,910	105	129,477	4,467	2,293,524	225,165	10,422,322	16,514,212
	1890	12	6,458,924	76	103,445	3,757	1,734,764	147,432	7,906,036	10,556,865
	1880	16	3,712,616	...	...	4,121	1,541,816	...	3,484,625	6,054,032
Wisconsin	1905	14	6,237,505	172	218,729	2,397	1,381,553	437,906	6,751,966	10,453,750
	1900	12	5,918,329	91	115,449	1,921	1,216,850	361,571	5,410,066	8,905,226
	1890	9	6,461,531	30	50,754	1,890	981,787	175,405	4,613,753	6,501,761
	1880	8	2,768,218	...	...	2,153	1,004,931	...	3,830,667	6,580,391
All other states	[3] 1905	86	93,320,954	1,485	1,902,257	23,938	13,110,934	4,591,826	48,802,401	73,521,010
	[4] 1900	45	33,049,365	481	682,114	14,840	7,778,153	1,872,633	21,878,121	37,272,127
	[5] 1890	13	5,446,875	65	128,161	1,690	711,550	297,177	2,417,165	4,031,794
	[6] 1880	24	3,021,603	...	...	2,826	815,595	...	2,951,255	4,203,901

[1] Included in "all other states" in 1905.
[2] Included in "all other states" in 1890 and 1905.
[3] Includes establishments distributed as follows: Colorado, 2; Connecticut, 9; Georgia, 5; Kansas, 1; Kentucky, 9; Maine, 1; Maryland, 9; Massachusetts, 6; Minnesota, 1; Missouri, 6; Oregon, 1; Rhode Island, 4; Tennessee, 15; Texas, 1; Washington, 1; West Virginia, 15.
[4] Includes establishments distributed as follows: Colorado, 3; Connecticut, 8; Kansas, 1; Kentucky, 8; Maine, 1; Massachusetts, 8; Minnesota, 3; Missouri, 7; North Carolina, 2; Oregon, 1; Rhode Island, 1; Washington, 1; Wyoming, 1.
[5] Includes establishments distributed as follows: Colorado, 2; Iowa, 1; Maine, 2; Minnesota, 1; New Hampshire, 1; North Carolina, 1; Oregon, 1; Rhode Island, 1; Texas, 1; Washington, 1; Wyoming, 1.
[6] Includes establishments distributed as follows: Colorado, 1; District of Columbia, 1; Kansas, 2; Maine, 3; Nebraska, 1; New Hampshire, 2; North Carolina, 9; Oregon, 1; Rhode Island, 1; Vermont, 2; Wyoming, 1.

Pennsylvania, Ohio, and Illinois were the leading states in 1905, as well as in 1900 and 1890. Pennsylvania produced 52 per cent of the value of all iron and steel products in 1905, as against 54 per cent in 1900, and 55.3 per cent in 1890; Ohio, 16.9 per cent in 1905, 17.3 per cent in 1900, and 13.6 per cent in 1890; and Illinois, 9.6 per cent in 1905, 7.5 per cent in 1900, and 8.1 per cent in 1890. The next state in rank, New York, produced 3.3 per cent of the products.

Of the capital invested in the iron and steel industry, Pennsylvania reported 49.8 per cent in 1905 and 54.5 per cent in 1900; Ohio, 13.8 per cent in 1905 and 14.6 per cent in 1900; and Illinois, 6.2 per cent in 1905 and 7.3 per cent in 1900.

Pennsylvania employed 51.4 per cent of all wage-earners in the industry in 1905 and 49.8 per cent in 1900; Ohio, 13.7 per cent in 1905 and 15.1 per cent in 1900; and Illinois, 7.6 per cent in 1905 and 7.5 per cent in 1900. In the matter of wages, Pennsylvania contributed 51.7 per cent of all wages in 1905 and 51.2 per cent in 1900; Ohio, 15.6 per cent in 1905 and 16.3 per cent in 1900; Illinois, 8.1 per cent in 1905 and 8 per cent in 1900. In cost of materials used Pennsylvania's share of the total was 52.3 per cent in 1905 and 54.2 per cent in 1900; that of Ohio, 17.8 per cent in 1905 and 17.5 per cent in 1900; and that of Illinois, 9.3 per cent in 1905 and 8 per cent in 1900.

As a combination of the statistics of these 3 leading states was made in prior reports, a like presentation will be given. The combined capital invested at the census of 1905 was $662,405,541, or 69.8 per cent of the total capital, compared with $451,819,450, or 76.5 per cent of the total in 1900; with $298,627,213, or 72.1 per cent, in 1890; and with $131,559,449, or 62.7 per cent, in 1880. The average number of wage-earners employed in 1905 was 176,319, or 72.6 per cent of the total number, compared with 161,183, or 72.4 per cent, in 1900; with 124,704, or 72.8 per cent, in 1890; and with 83,276, or 59.1 per cent, in 1880. The wages paid in 1905 aggregated $106,667,940, or 75.4 per cent of the total amount, compared with $91,279,590, or 75.5 per cent, in 1900; with $68,033,-689, or 76.2 per cent, in 1890; and with $35,869,638, or 64.7 per cent, in 1880. The cost of materials in 1905 aggregated $492,538,582, or 79.4 per cent of the total, compared with $416,201,353, or 79.7 per cent, in 1900; with $254,811,212, or 77.9 per cent, in 1890; and with $131,242,090, or 68.6 per cent, in 1880. The value of the products aggregated $711,440,729, or 78.5 per cent of the total in 1905, compared with $633,683,600, or 78.8 per cent, in 1900; with $368,789,503, or 77 per cent, in 1890; and with $201,039,917, or 67.8 per cent, in 1880.

The state of New York ranked fourth in the value of all iron and steel products in 1905, whereas in 1900 it was eighth; Alabama was fifth, instead of sixth as in 1900; New Jersey was sixth, whereas in 1900 it was fourth; West Virginia, seventh (same in 1900); Indiana,

eighth (fifth in 1900); Maryland, ninth (eleventh in 1900); Massachusetts, tenth (ninth in 1900); Wisconsin, eleventh (tenth in 1900); Colorado, twelfth; Michigan, thirteenth (fourteenth in 1900); Kentucky, fourteenth (thirteenth in 1900); and Connecticut, fifteenth. None of the other states exceeded $5,000,000 in value of iron and steel products.

An increase in value of products is shown for all states given in detail except for Delaware, Indiana, New Jersey, and Virginia. Delaware shows a decrease in products of 49.4 per cent, with a decrease in materials used, wage-earners, and wages paid, accompanied by a very considerable increase in capital; Indiana shows a decrease in products of 12.5 per cent, and a decrease in cost of materials, wage-earners, and wages paid, likewise accompanied by an increase in capital; New Jersey shows a decrease of 2.9 per cent in value of products, with a decrease in cost of materials, and an increase in wage-earners, wages paid, and capital; and Virginia shows a decrease of 41.7 per cent in value of products, with a decrease in cost of materials, wage-earners, wages paid, and capital.

COMPARATIVE PRODUCTION BY STATES.

Table 3 shows the production of all forms of iron and steel, by states, from 1870 to 1905, and the rank of each producing state in quantity of products, for each census.

TABLE 3.—IRON AND STEEL—QUANTITY OF CLASSIFIED PRODUCTS, BY STATES, WITH RANK OF STATES: 1870 TO 1905.

STATE.	RANK.					QUANTITY (TONS).				
	1905	1900	1890	1880	1870	1905	1900	1890	1880	1870
United States						[1] 34,844,933	29,507,860	16,264,478	6,486,733	3,263,585
Pennsylvania	1	1	1	1	1	17,555,031	15,290,711	8,622,745	3,229,168	1,640,007
Ohio	2	2	2	2	2	6,521,213	5,297,191	2,210,296	830,483	401,579
Illinois	3	3	3	4	15	3,318,495	2,954,876	1,479,754	373,185	23,001
Alabama	4	4	4	15	20	1,736,580	1,303,595	864,120	56,237	6,304
New York	5	6	5	3	3	1,178,911	475,635	530,100	534,196	400,229
West Virginia	6	5	6	7	10	653,999	541,106	347,506	131,685	64,587
Maryland	7	8	15	12	5	609,047	468,558	109,088	99,048	85,200
Indiana	8	9	14	13	11	446,458	425,946	113,090	85,819	57,275
New Jersey	9	12	9	5	4	423,739	292,154	270,920	217,732	102,912
Wisconsin	10	10	10	6	12	387,625	404,827	258,784	159,763	37,709
Michigan	11	15	11	8	8	326,087	221,860	239,656	127,426	77,392
Tennessee	12	11	8	14	14	322,830	387,649	282,625	68,839	30,629
Virginia	13	7	7	16	13	312,691	469,060	325,722	49,752	33,782
Colorado	14	14	20	27		268,621	232,815	30,207	4,018	
Kentucky	15	13	16	11	7	201,898	255,875	83,357	110,492	77,439
Massachusetts	16	16	12	9	9	147,347	140,532	141,965	126,179	76,916
Connecticut	17	18	19	17	16	105,934	54,365	44,627	33,983	22,594
Missouri	18	17	13	10	6	103,735	100,001	114,945	112,284	84,723
Georgia	19	22	21	18	18	84,070	21,505	27,633	31,386	8,602
Delaware	20	19	17	19	19	31,851	53,025	52,176	30,284	7,417
California	21	21	18	21	22	31,045	25,419	50,667	12,500	2,679
Rhode Island	22	26	23	24	21	25,961	5,618	11,613	7,263	3,942
Minnesota	23	20	30			20,769	42,528	2,290		
Oregon	24	28	26	28		18,000	4,505	7,510	2,857	
Washington	25	27	28			5,760	5,000	4,274		
Texas	26	24	25	30		4,669	9,789	7,991	1,250	
Maine	27	29	22	22	17	2,567	2,750	12,500	9,702	15,302
North Carolina		23	29	31	23		11,543	3,015	392	1,608
Wyoming		25	24	23			9,422	8,308	8,741	
New Hampshire			27	25				5,938	7,123	
Iowa			31					1,056		
Kansas				20					17,013	
Vermont				26	24				5,911	1,362
Nebraska				29					1,786	
District of Columbia				32					236	
South Carolina					25					395

[1] Exclusive of 4,184 tons of steel castings made by establishments engaged primarily in the manufacture of other products.

In 1905, 27 states figure as producers, as against 29 in 1900, no products being reported from North Carolina and Wyoming. Production has increased in all states with the exception of Wisconsin, Tennessee, Virginia, Kentucky, Delaware, Minnesota, Texas, and Maine.

Pennsylvania, Ohio, Illinois, and Alabama hold the first four ranking positions, as they did in 1900 and 1890, and produced as a whole 29,131,319 tons, or 83.6 per cent of the total production, compared with 84.2 per cent in 1900, 81 per cent in 1890, 69.2 per cent in 1880, and 63.5 per cent in 1870. Pennsylvania increased its output 14.8 per cent over 1900, and produced 50.4 per cent of the total products in 1905, 51.8 per cent in 1900, 53 per cent in 1890, 49.8 per cent in 1880, and 50.3 per cent in 1870. The product of Ohio shows an increase of 23.1 per cent over 1900, and forms 18.7 per cent of the total in 1905, compared with 18 per cent in 1900, 13.6 per cent in 1890, 12.8 per cent in 1880, and 12.3 per cent in 1870.

The product of Illinois in 1905 increased 12.3 per cent over that of 1900, and constituted 9.5 per cent of

the total, as compared with 10 per cent in 1900, 9.1 per cent in 1890, 5.8 per cent in 1880, and seven-tenths of 1 per cent in 1870. Alabama produced 33.2 per cent more iron and steel products in 1905 than in 1900, and they constituted 5 per cent of the total, as against 4.4 per cent in 1900, 5.3 per cent in 1890, nine-tenths of 1 per cent in 1880, and two-tenths of 1 per cent in 1870.

New York advanced in 1905 to fifth place, and shows an increase of 147.9 per cent over its product of 1900. It produced 3.4 per cent of the total in 1905 and 1.6 per cent in 1900.

West Virginia, although showing a large increase (20.9 per cent) in product over 1900, was outstripped by New York, and moved back to sixth place.

Maryland increased its output 30 per cent over 1900; Indiana, 4.8 per cent; and New Jersey, 45 per cent. Wisconsin shows a loss of 4.2 per cent; Michigan, a gain of 47 per cent; Tennessee, a decrease of 16.7 per cent; Virginia, a decrease of 33.3 per cent—dropping from seventh to thirteenth place; Colorado, an increase of 15.4 per cent; Kentucky, a decrease of 21.1 per cent; Massachusetts, an increase of 4.8 per cent; Connecticut, an increase of 94.9 per cent; and Missouri, an increase of 3.7 per cent. Of the states producing smaller amounts, Georgia shows a relatively large gain of 290.9 per cent, and Rhode Island and Oregon show products approximately fourfold those of 1900.

CAPITAL.

Table 4 presents the capital invested in the active and idle establishments of the iron and steel industry for the census years from 1880 to 1905, inclusive. The capital invested in rented property is included. Plants in course of construction are not included.

TABLE 4.—*Iron and steel—active and idle establishments—capital: 1880 to 1905.*

	Census.	Number of establishments.	CAPITAL. Total.	Buildings, machinery, tools, and implements.	Land, cash, and sundries.
Total	1905	759	[1] $992,774,034	$570,808,117	$421,965,917
	1900	763	[1] 608,898,516	300,365,655	308,532,861
	1890	838	[1] 426,413,902	209,382,875	217,031,027
	1880	992	228,844,953	121,414,777	107,430,176
Active	1905	606	948,689,840	536,999,569	411,690,271
	1900	669	590,530,484	287,669,533	302,860,951
	1890	719	414,044,844	200,197,208	213,847,636
	1880	792	209,904,965	112,320,428	97,584,537
Idle	1905	153	44,084,194	33,808,548	10,275,646
	1900	94	18,368,032	12,696,122	5,671,910
	1890	119	12,369,058	9,185,667	3,183,391
	1880	200	18,939,988	9,094,349	9,845,639

[1] Includes value of rented property—1905, $13,193,239; 1900, $17,245,416; 1890, $8,291,058.

In 1905 the capital invested in idle establishments was 4.4 per cent of the total, as compared with 3 per cent in 1900, 2.9 per cent in 1890, and 8.3 per cent in 1880. Of the number of establishments, 20.2 per cent were idle in 1905, compared with 12.3 per cent in 1900, 14.2 per cent in 1890, and 20.2 per cent in 1880.

The distribution of the invested capital between blast furnace establishments, steel works and rolling mills, and forges and bloomeries for the several census years, with the percentage each is of the total capital, 1880 to 1905, inclusive, is shown in Table 5.

TABLE 5.—IRON AND STEEL—ACTIVE AND IDLE ESTABLISHMENTS—CAPITAL, BY BRANCHES: 1880 TO 1905.

	Census.	TOTAL. Number of establishments.	TOTAL. Capital.[1]	BLAST FURNACES. Number of establishments.	BLAST FURNACES. Capital.	STEEL WORKS AND ROLLING MILLS. Number of establishments.	STEEL WORKS AND ROLLING MILLS. Capital.	FORGES AND BLOOMERIES. Number of establishments.	FORGES AND BLOOMERIES. Capital.	PER CENT OF TOTAL. Blast furnaces.	PER CENT OF TOTAL. Steel works and rolling mills.	PER CENT OF TOTAL. Forges and bloomeries.
Total	1905	759	$992,774,034	265	$262,395,742	487	$730,121,653	7	$256,639	26.4	73.6	[2]
	1900	763	608,898,516	273	158,352,558	476	449,926,470	14	619,488	26.0	73.9	0.1
	1890	838	426,413,902	377	141,067,408	429	284,271,524	32	1,074,970	33.1	66.7	0.2
	1880	992	228,844,953	483	103,926,245	391	120,522,745	118	4,395,963	45.4	52.7	1.9
Active	1905	606	948,689,840	191	239,559,194	409	708,908,534	6	222,112	25.3	74.7	[1]
	1900	669	590,530,484	224	148,226,113	438	441,795,983	7	508,388	25.1	74.8	0.1
	1890	719	414,044,844	304	134,608,543	395	278,559,831	20	876,470	32.5	67.3	0.2
	1880	792	209,904,965	341	89,531,362	358	116,458,390	93	3,915,213	42.6	55.5	1.9
Idle	1905	153	44,084,194	74	22,836,548	78	21,213,119	1	34,527	51.8	48.1	0.1
	1900	94	18,368,032	49	10,126,445	38	8,130,487	7	111,100	55.1	44.3	0.6
	1890	119	12,369,058	73	6,458,865	34	5,711,693	12	198,500	52.2	46.2	1.6
	1880	200	18,939,988	142	14,394,883	33	4,064,355	25	480,750	76.0	21.5	2.5

[1] Includes value of rented property as follows: Blast furnaces—1905, $4,165,283; 1900, $5,087,881; 1890, $5,061,058. Steel works and rolling mills—1905, $9,018,456; 1900, $11,888,815; 1890, $3,230,000. Forges and bloomeries—1905, $9,500; 1900, $236,000.
[2] Less than one-tenth of 1 per cent.

For comparative purposes the capital invested in 1905 in forges and bloomeries is shown in detail, as well as the capital pertaining to blast furnaces, distinct from that invested in steel works and rolling mills; but in the other tables, except as especially noted, statistics for the few existing forges and bloomeries are embodied in the statistics for steel works and rolling mills. The forges and bloomeries as reported both for 1905 and the former years comprise only establishments which manufacture for sale hammered blooms,

bars, etc., and do not include establishments which have rolling mill equipments and consume in their own works the charcoal blooms or bars made.

In comparing capital for 1880 with that of the later years, it should be remembered that the former includes capital invested by iron and steel establishments in mining and in other operations.

The capital invested in steel works and rolling mills has increased, as a rule, faster than the capital invested in blast furnaces, the increase of capital in blast furnaces showing a slight relative increase from 1900 to 1905 over that for steel works and rolling mills, while the capital invested in forges and bloomeries has rapidly decreased. Thus from 1880 to 1890 the total capital invested in steel works and rolling mills increased 135.9 per cent; in blast furnaces, 35.7 per cent; and in forges and bloomeries it decreased 75.5 per cent. From 1890 to 1900 capital of steel works and rolling mills increased 58.3 per cent; that of blast furnaces, 12.3 per cent; and that of forges and bloomeries decreased 42.4 per cent. From 1900 to 1905 capital of steel works and rolling mills increased 62.3 per cent; that of blast furnaces, 65.7 per cent; and that of forges and bloomeries decreased 58.6 per cent.

The average investment in blast furnaces and in steel works and rolling mills per establishment has increased heavily since 1890, as shown by the following tabular statement:

CENSUS.	Blast furnaces.	Steel works and rolling mills.	Forges and bloomeries.
1905	$990,173	$1,499,223	$36,663
1900	580,046	945,224	44,249
1890	374,184	662,638	33,593

In the fifteen-year period the average amount of capital per establishment for blast furnaces and steel works and rolling mills has more than doubled.

Table 6 is a comparative summary, by states, of the capital invested in active and idle establishments from 1880 to 1905.

TABLE 6.—IRON AND STEEL—ACTIVE AND IDLE ESTABLISHMENTS—CAPITAL, BY STATES: 1880 TO 1905.

STATE.	Census.	TOTAL.		ACTIVE.		IDLE.	
		Number of establishments.	Capital.	Number of establishments.	Capital.	Number of establishments.	Capital.
United States	1905	759	[1] $992,774,034	606	$948,689,840	153	$44,084,194
	1900	763	[1] 608,898,516	669	590,530,484	[illegible]	18,368,032
	1890	838	[1] 426,413,902	719	414,044,844	119	12,369,058
	1880	992	228,844,953	792	209,904,965	200	18,939,988
Alabama	1905	40	32,377,747	29	29,153,289	11	3,224,458
	1900	35	18,292,468	25	16,091,479	10	2,200,989
	1890	38	18,284,976	35	17,987,583	3	297,393
	1880	13	3,156,196	8	2,757,196	5	399,000
California	1905	4	1,110,192	4	1,110,192	...	...
	1900	4	1,514,162	3	1,499,162	1	15,000
	1890	4	4,656,611	4	4,656,611	...	...
	1880	1	1,000,000	1	1,000,000	...	...
Connecticut [2]	1890	15	2,317,821	13	2,189,521	2	128,300
	1880	19	2,682,000	17	2,557,000	2	125,000
Delaware	1905	6	6,405,585	5	6,279,585	1	126,000
	1900	6	4,207,079	6	4,207,079	...	...
	1890	9	2,960,722	7	2,558,865	2	401,857
	1880	9	1,431,469	8	1,341,469	1	90,000
Georgia [3]	1900	5	1,218,216	3	666,916	2	551,300
	1890	6	951,243	5	908,243	1	43,000
	1880	14	1,135,900	9	973,800	5	162,100
Illinois	1905	29	59,392,825	27	58,595,150	2	797,675
	1900	27	43,370,239	26	43,356,239	1	14,000
	1890	28	35,203,169	24	34,689,919	4	513,250
	1880	20	6,285,620	16	5,795,620	4	490,000
Indiana	1905	34	26,643,104	21	22,985,691	13	3,657,413
	1900	29	15,594,210	27	14,994,210	2	600,000
	1890	18	4,387,095	15	4,099,095	3	288,000
	1880	12	2,283,000	12	2,283,000	...	...
Kentucky [2]	1890	13	2,690,655	9	2,310,655	4	380,000
	1880	29	5,493,035	18	4,610,035	11	883,000
Maryland [3]	1900	12	4,012,937	9	3,765,003	3	247,934
	1890	13	4,602,574	10	4,217,574	3	385,000
	1880	23	4,962,125	18	4,402,125	5	560,000
Massachusetts [2]	1890	16	9,068,555	15	9,005,555	1	63,000
	1880	30	6,738,408	24	6,163,408	6	575,000
Michigan	1905	16	6,080,677	16	6,080,677	...	...
	1900	16	4,623,031	10	3,934,050	6	688,981
	1890	25	7,070,241	19	6,696,541	6	373,700
	1880	21	4,155,386	15	3,342,386	6	813,000

[1] Includes value of rented property—1905, $13,193,239; 1900, $17,245,416; 1890, $8,291,058.
[2] Included in "all other states" in 1905 and 1900.
[3] Included in "all other states" in 1905.

TABLE 6.—IRON AND STEEL—ACTIVE AND IDLE ESTABLISHMENTS—CAPITAL, BY STATES: 1880 TO 1905—Continued.

STATE.	Census.	TOTAL.		ACTIVE.		IDLE.	
		Number of establishments.	Capital.	Number of establishments.	Capital.	Number of establishments.	Capital.
Minnesota[1]	1900	5	2,163,582	3	713,806	2	1,449,776
	1880	1	150,000	....	....	1	150,000
Missouri[2]	1890	13	5,890,428	9	3,495,913	4	2,394,515
	1880	20	8,803,100	12	5,698,600	8	3,104,500
New Jersey	1905	28	53,808,280	21	51,794,677	7	2,013,603
	1900	30	21,011,152	25	20,336,609	5	674,543
	1890	37	12,649,162	28	11,697,362	9	951,800
	1880	40	9,099,050	37	8,764,050	3	335,000
New York	1905	38	67,163,295	29	64,041,775	9	3,121,520
	1900	37	16,008,878	30	13,292,346	7	2,716,532
	1890	55	17,330,190	44	16,282,435	11	1,047,755
	1880	89	21,543,2[illegible]1	74	19,752,471	15	1,790,750
Ohio	1905	111	136,032,358	90	131,262,446	21	4,769,912
	1900	109	86,557,552	107	86,477,552	2	80,000
	1890	117	39,839,900	101	37,642,887	16	2,197,013
	1880	133	25,052,294	103	22,807,606	30	2,244,688
Pennsylvania	1905	301	490,328,837	251	472,547,945	50	17,780,892
	1900	320	326,053,204	291	321,985,659	29	4,067,545
	1890	341	227,626,582	311	226,294,407	30	1,332,175
	1880	362	106,564,223	321	102,956,223	41	3,608,000
Tennessee[3]	1900	19	5,883,315	16	5,432,665	3	450,650
	1890	18	4,869,855	15	4,613,355	3	256,500
	1880	43	3,681,776	29	2,862,826	14	818,950
Texas[1]	1900	4	653,215	3	379,215	1	274,000
	1880	1	40,000	1	40,000	....	....
Virginia	1905	27	8,060,779	13	5,279,954	14	2,780,825
	1900	29	8,236,858	20	6,941,696	9	1,295,162
	1890	30	6,584,793	21	6,330,993	9	253,800
	1880	43	3,829,713	21	2,294,713	22	1,535,000
West Virginia[3]	1900	12	8,333,445	11	8,202,910	1	130,535
	1890	13	6,488,924	12	6,458,924	1	30,000
	1880	19	3,873,616	16	3,712,616	3	161,000
Wisconsin	1905	18	7,785,330	14	6,237,505	4	1,547,825
	1900	13	7,238,654	12	5,918,329	1	1,320,325
	1890	10	6,468,031	9	6,461,531	1	6,500
	1880	9	2,843,218	8	2,768,218	1	75,000
All other states	[4] 1905	107	97,585,025	86	93,320,954	21	4,264,071
	[5] 1900	51	33,926,319	42	32,335,559	9	1,590,760
	[6] 1890	19	6,472,375	13	5,446,875	6	1,025,500
	[7] 1880	41	4,041,603	24	3,021,603	17	1,020,000

[1] Included in "all other states" in 1905 and 1890.
[2] Included in "all other states" in 1905 and 1900.
[3] Included in "all other states" in 1905.
[4] Includes establishments distributed as follows: Colorado, 2; Connecticut, 9; Georgia, 5; Kansas, 1; Kentucky, 13; Maine, 1; Maryland, 10; Massachusetts, 8; Minnesota, 2; Missouri, 7; North Carolina, 2; Oregon, 2; Rhode Island, 4; Tennessee, 18; Texas, 4; Washington, 2; West Virginia, 16; Wyoming, 1.
[5] Includes establishments distributed as follows: Colorado, 3; Connecticut, 11; Kansas, 1; Kentucky, 10; Maine, 2; Massachusetts, 8; Missouri, 7; North Carolina, 3; Oregon, 2; Rhode Island, 1; Washington, 2; Wyoming, 1.
[6] Includes establishments distributed as follows: Colorado, 3; Iowa, 1; Kansas, 1; Maine, 2; Minnesota, 2; New Hampshire, 1; North Carolina, 1; Oregon, 1; Rhode Island, 1; Texas, 5; Washington, 1; Wyoming, 1.
[7] Includes establishments distributed as follows: Colorado, 1; District of Columbia, 1; Kansas, 2; Maine, 3; Nebraska, 1; New Hampshire, 2; North Carolina, 20; Oregon, 1; Rhode Island, 3; Utah, 3; Vermont, 4; Wyoming, 1.

MISCELLANEOUS EXPENSES.

In taking the census of 1880 reports of miscellaneous expenses, including expenditures for taxes, rent of offices, interest, insurance, advertising, etc., were not secured. At the census of 1890 they were reported, but the miscellaneous expenses chargeable to the mining of ore and coal, the quarrying of limestone, the making of coke or charcoal, and railroad operations, when these were in conjunction with blast furnace operations, were included as well, so that these expenses do not represent those of the iron and steel industry proper.

At the census of 1900 and the present census efforts were made to secure as nearly as possible the miscellaneous expenses chargeable to the operations of the iron and steel departments. The expense of the sales department and amounts expended as commissions on orders has not been included.

The miscellaneous expenses in 1905 constituted 5.7 per cent of all expense reported, compared with 4.7 per cent in 1900 and 4.1 per cent in 1890.

WAGE-EARNERS.

Table 7 shows the average number of wage-earners employed in the iron and steel industry and its several branches for 1880 and subsequent census years and the percentages of men, women, and children employed.

TABLE 7.—IRON AND STEEL—WAGE-EARNERS (MEN, WOMEN, AND CHILDREN), WITH PER CENT OF TOTAL, BY BRANCHES: 1880 TO 1905.

CLASS.	Census.	AVERAGE NUMBER.				PER CENT OF TOTAL.		
		Total.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Men.	Women.	Children.
Total	1905	242,740	239,383	1,455	1,902	98.6	0.6	0.8
	1900	222,607	219,635	1,071	1,901	98.7	0.5	0.8
	1890	171,181	168,943	58	2,180	98.7	(1)	1.3
	1880	140,798	133,023	45	7,730	94.5	(1)	5.5
Blast furnaces	1905	35,178	35,093	4	81	99.8	(1)	0.2
	1900	39,358	39,261	6	91	99.8	(1)	0.2
	1890	33,415	33,341	....	74	99.8	....	0.2
	1880	41,695	40,503	9	1,183	97.2	(1)	2.8
Steel works and rolling mills	1905	207,494	204,222	1,451	1,821	98.4	0.7	0.9
	1900	183,023	180,148	1,065	1,810	98.4	0.6	1.0
	1890	137,295	135,134	58	2,103	98.5	(1)	1.5
	1880	96,164	89,645	33	6,486	93.2	(1)	6.8
Forges and bloomeries	1905	68	68	....	....	100.0	....	....
	1900	226	226	....	....	100.0	....	....
	1890	471	468	....	3	99.4	....	0.6
	1880	2,939	2,875	3	61	97.8	0.1	2.1

1 Less than one-tenth of 1 per cent.

At the census of 1905 the labor employed by blast furnaces constituted 14.5 per cent of the total; that employed by steel works and rolling mills, 85.5 per cent; and that employed by forges and bloomeries was, in comparison, a negligible quantity. In 1900 blast furnace establishments employed 17.7 per cent of all labor; steel works and rolling mills, 82.2 per cent; and forges and bloomeries, one-tenth of 1 per cent. In 1890 blast furnaces employed 19.5 per cent of the total; steel works and rolling mills, 80.2 per cent; and forges and bloomeries, three-tenths of 1 per cent. In 1880 blast furnace labor was 29.6 per cent of the total; that of steel works and rolling mills, 68.3 per cent; and that of forges and bloomeries, 2.1 per cent. It will be seen that the average number of wage-earners employed in the steel works and rolling mill branch of the industry has constituted in each successive year a larger proportion of the total, increasing from 68.3 per cent in 1880 to 85.5 per cent of all labor in 1905; that the wage-earners employed in the blast furnace branch have fluctuated in number, but constitute a smaller portion of the total, decreasing from 29.6 per cent in 1880 to 14.5 per cent in 1905; and that the labor employed in forges and bloomeries has rapidly decreased.

The women and children employed as wage-earners are practically all in steel works and rolling mills. The women employed are distributed, in the order of numbers, in New Jersey, Pennsylvania, Illinois, Ohio, Massachusetts, New York, Connecticut, Indiana, Maryland, Kentucky, and California. The main increase in number, 1900 to 1905, has been in the states of New Jersey, Illinois, Ohio, Connecticut, and New York. The total number of children employed remained substantially the same, the decreases in certain states counterbalancing the increase in others. The principal increases in number of children employed, 1900 to 1905, have been—in Alabama, from 24 to 181; in Pennsylvania, from 1,082 to 1,236; in Maryland, from 23 to 75; in Ohio, from 43 to 72; in Kentucky, from 15 to 35; and in Delaware, from 9 to 27. New Jersey and New York reported 65 and 18, respectively, in 1900, and none employed in 1905. Illinois shows a decrease from 193 to 13; Indiana, from 80 to 3; West Virginia, from 140 to 84; and Missouri, from 15 to 4.

MATERIALS USED.

The statistics with respect to the materials used in the iron and steel industry—blast furnaces, steel works and rolling mills, and forges and bloomeries—for the census years 1880, 1890, 1900, and 1905 are given in Tables 8, 9, and 10, which follow. In taking the census of 1900, as well as that of 1905, an effort was made to obtain the cost of materials used, f. o. b. cars at point of shipment, in order that the amount paid for freight charges might be definitely ascertained. This proved futile, however, as some establishments reported cost of materials f. o. b. works, while others reported the cost at point of shipment and the total amount paid as freight as a separate item, and still others reported partly one way and partly the other. At the census of 1890, as well as in that of 1880, the cost reported for materials used was the cost at the works. When freight charges for 1905 are not combined in the cost reported, the amount is shown in the detailed tables at the end of this report, as a separate item.

Table 8 shows the quantity and cost of fuel used in blast furnaces, steel works and rolling mills, and forges and bloomeries in 1880, 1890, 1900, and 1905, by kinds. In the case of steel works and rolling mills in 1905, owing to an effort to secure a segregation of fuel used for power from that used for heating and melting purposes, the value of the fuel used for power was reported, but not the kind and quantity of fuel so used.

TABLE 8.—IRON AND STEEL—FUEL CONSUMED, BY KIND, QUANTITY, AND COST, BY BRANCHES: 1880 TO 1905.

KIND.	Census.	TOTAL.		BLAST FURNACES.		STEEL WORKS AND ROLLING MILLS.		FORGES AND BLOOMERIES.	
		Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.
Total cost	1905		$98,095,303		$62,902,342		$35,175,341		$17,620
	1900		66,652,344		44,221,702		22,342,390		88,252
	1890		55,561,749		37,884,383		17,397,434		279,932
	1880		35,969,873		21,917,002		13,202,597		850,274
		Long tons.		*Long tons.*		*Long tons.*		*Long tons.*	
Anthracite coal and culm	1905	791,762	2,605,041	560,637	1,812,779	231,125	792,262		
	1900	1,830,582	3,518,113	886,564	2,297,419	944,018	1,220,694		
	1890	2,655,280	6,654,420	1,796,854	5,165,761	858,071	1,487,713	355	946
	1880	2,966,517	9,889,037	2,334,984	8,012,755	631,229	1,875,062	304	1,220
Bituminous coal and slack	1905	7,856,733	15,708,931	801,640	1,340,997	7,054,099	14,365,633	994	2,301
	1900	11,777,834	15,783,887	832,235	1,101,312	10,944,046	14,679,804	1,553	2,771
	1890	5,110,187	10,426,030	491,971	759,522	4,617,055	9,663,208	1,161	3,300
	1880	5,052,727	12,610,440	939,065	2,095,887	4,112,222	10,510,255	1,440	4,298
		Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
Coke	1905	20,378,452	59,136,419	19,739,676	57,127,027	638,747	2,009,295	29	97
	1900	17,388,116	40,991,400	16,461,533	38,976,770	926,516	2,014,390	67	240
	1890	9,632,390	28,752,972	9,237,935	27,435,780	393,051	1,311,588	1,404	5,604
	1880	2,277,555	8,743,382	2,128,255	8,129,240	142,605	582,901	6,695	31,241
		Bushels.		*Bushels.*		*Bushels.*		*Bushels.*	
Charcoal	1905	40,930,272	2,837,590	37,796,739	2,538,452	2,968,784	283,916	164,749	15,222
	1900	35,209,887	2,101,787	31,421,585	1,846,201	2,250,022	170,345	1,538,280	85,241
	1890	74,499,202	5,037,175	67,672,156	4,523,320	2,770,611	243,773	4,056,435	270,082
	1880	69,592,091	4,726,114	53,909,828	3,679,120	2,667,902	234,379	13,014,361	812,615
		Barrels.				*Barrels.*		*Barrels.*	
Oil used for fuel	1905	633,813	908,154			633,813	908,154		
	1900	1,302,615	1,158,748			1,302,615	1,158,748		
	1890	1,859,138	1,124,206			1,859,138	1,124,206		
	1880	853	900					853	900
Fuel used for power	1905		12,433,414		(1)		12,433,414		(1)
Natural gas	1905		4,465,754		[2] 83,087		4,382,667		
	1900		3,098,409				3,098,409		
	1890		3,566,946				3,566,946		
	1880								

[1] Not reported separately.

[2] For steam raising.

The cost of fuel used for power, as reported for steel works and rolling mills, amounted to $12,433,414. As this fuel is not distributed by kinds, either as to quantities or values, no comparisons of 1905 with the former years can properly be made, so far as the fuel consumed by steel works and rolling mills or the total fuel consumption by kinds is concerned. The total cost of the fuel consumed shows an increase of 47.2 per cent for 1905 over 1900, as compared with an increase of 20 per cent for 1900, and 54.5 per cent for 1890. The fuel consumed by blast furnaces shows an increase of 42.2 per cent in 1905, as against 16.7 per cent in 1900, and 72.9 per cent in 1890. The fuel cost for steel works and rolling mills shows an increase of 57.4 per cent in 1905, as against 28.4 per cent in 1900, and 31.8 per cent in 1890. Forges and bloomeries, on the other hand, show a decrease of 80 per cent in 1905, 68.5 per cent in 1900, and 67.1 per cent in 1890.

The fuel consumed in the pig iron industry at different census years is comparable by kinds, and the statistics show that the increase is in coke consumption, the use of bituminous coal and anthracite coal both showing a decrease. Anthracite coal and culm has decreased steadily, at the rate of 23 per cent in 1890, as compared with 1880; 50.7 per cent in 1900, as compared with 1890; and 36.8 per cent in 1905, as compared with 1900. Bituminous coal and slack shows a decrease in 1905, as compared with 1900 and 1880, though the amount consumed in 1890 was materially less, as reported, than in the preceding and later years. The consumption of coke shows a steady and heavy increase, namely, 334.1 per cent in 1890, 78.2 per cent in 1900, and 19.9 per cent in 1905.

The consumption of charcoal shows an increase of 20.3 per cent in 1905 over 1900; a decrease in 1900 of 53.6 per cent over 1890; and an increase of 25.5 per cent in 1890 over 1880. These changes are in keeping with the increase of the charcoal pig iron product from 1880 to 1890, the decrease in 1900, and the increase shown in 1905.

Table 9 shows the quantity and cost of iron ore, mill cinder, and fluxing material consumed in the manufacture of iron and steel in the several census years, 1880 to 1905.

Table 9.—IRON AND STEEL—QUANTITY AND COST OF IRON ORE, MILL CINDER, AND FLUXING MATERIAL CONSUMED, BY BRANCHES: 1880 TO 1905.

	Census.	TOTAL.		BLAST FURNACES.		STEEL WORKS AND ROLLING MILLS.		FORGES AND BLOOMERIES.	
		Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.
Total	1905	40,784,786	$114,070,455	40,234,791	$111,673,663	549,995	$2,396,792		
	1900	34,649,109	76,089,080	34,302,799	74,740,271	340,028	1,326,395	6,282	$22,414
	1890	21,725,699	74,254,942	21,189,708	70,789,216	519,199	3,355,139	16,792	110,587
	1880	10,029,379	39,974,700	9,624,894	36,663,281	333,405	2,779,879	71,080	531,540
Iron ore	1905	30,592,180	103,346,823	30,042,185	100,950,031	549,995	2,396,792		
	1900	25,722,090	67,257,063	25,375,780	65,908,254	340,028	1,326,395	6,282	22,414
	1890	15,558,412	66,971,256	15,022,421	63,505,530	519,199	3,355,139	16,792	110,587
	1880	6,883,667	36,516,697	6,479,182	33,205,278	333,405	2,779,879	71,080	531,540
Mill cinder, scrap, etc	1905	1,865,385	3,830,961	1,865,385	3,830,961				
	1900	1,600,313	3,772,385	1,600,313	3,772,385				
	1890	1,145,599	3,086,808	1,145,599	3,086,808				
	1880	316,114	910,667	316,114	910,667				
Fluxing material	1905	8,327,221	6,892,671	8,327,221	6,892,671				
	1900	7,326,706	5,059,632	7,326,706	5,059,632				
	1890	5,021,688	4,196,878	5,021,688	4,196,878				
	1880	2,829,598	2,547,336	2,829,598	2,547,336				

The consumption of iron ore increased 18.9 per cent in 1905 over 1900, as compared with an increase of 65.3 per cent shown in 1900 and an increase of 126 per cent in 1890. The relatively small amount used in steel works and rolling mills, it will be observed, showed a large decrease in 1900, largely due to decrease in the number of active puddling furnaces. The decrease in the amount of iron ore consumed by steel works and rolling mills has been more than regained through the general growth of the industry, the amount consumed in 1905 slightly exceeding that used in 1890. No consumption of iron ore is reported by the forges and bloomeries manufacturing blooms and bars for sale. The iron ore consumed shows an average cost of $3.38 per ton in 1905, as compared with $2.61 in 1900, $4.30 in 1890, and $5.30 in 1880.

The mill cinder, scrap, etc., is that which is purchased by the reporting establishments and does not include such material when made and consumed by the same establishment. The amount shows a steady increase, and an average cost in 1905 of $2.05 per ton, as compared with $2.36 in 1900, $2.69 in 1890, and $2.88 in 1880.

The quantity of fluxing material used shows an increase of 13.7 per cent from 1900 to 1905, 45.9 per cent from 1890 to 1900, and 77.5 per cent from 1880 to 1890. The average cost per ton was 83 cents in 1905, 69 cents in 1900, 84 cents in 1890, and 90 cents in 1880.

Table 10 shows the quantity and cost of pig iron, scrap iron and steel, and all forms of iron and steel purchased and consumed by steel works and rolling mills and forges and bloomeries in 1880, 1890, 1900, and 1905. The scrap iron and steel embraces only purchased material, and does not include scrap produced by iron and steel plants and consumed by the producing establishment.

Table 10.—IRON AND STEEL—QUANTITY AND COST OF IRON AND STEEL USED AS MATERIAL: 1880 TO 1905.

KIND.	1905		1900		1890		1880	
	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.
Total	22,762,901	$366,454,993	18,551,442	$321,146,512	8,735,762	$179,288,771	3,811,289	$113,424,247
Pig iron, spiegeleisen, ferromanganese, and all other pig iron	12,191,228	172,101,436	10,411,281	151,064,348	5,854,252	105,492,718	2,395,333	62,814,151
Old iron or steel rails, and other scrap iron or steel	5,124,277	67,601,248	4,126,980	66,852,621	1,747,591	36,460,815	1,206,818	37,908,350
Purchased hammered iron ore blooms pig or scrap blooms, and imported Swedish billets and bars	81,969	1,781,126	32,720	1,150,575	49,867	2,329,138	92,261	5,993,145
Purchased muck or scrap bar	205,951	5,066,732	161,329	4,535,939	209,534	6,252,594	47,995	2,369,544
Purchased iron or steel ingots, blooms, billets, tin plate bars, sheet bars, or slabs (except imported Swedish billets and bars)	4,632,257	103,420,970	3,682,407	92,123,412	874,518	28,753,506	68,882	4,339,057
Purchased wire rods	161,914	4,774,383	136,725	5,419,617	(1)	(1)	(1)	(1)
Purchased iron or steel skelp	259,643	7,331,935	(1)	(1)	(1)	(1)	(1)	(1)
All other iron or steel	105,662	4,377,163	(1)	(1)	(1)	(1)	(1)	(1)

[1] Not reported separately.

Every kind of iron and steel material purchased shows an increase for the period 1900 to 1905: Pig iron, an increase of 17.1 per cent; scrap iron and steel, 24.2 per cent; hammered scrap blooms and imported Swedish billets and bars, 150.5 per cent; muck or scrap bar, 27.7 per cent; ingots, blooms, billets, etc., not including Swedish billets, etc., 25.8 per cent; and wire rods (purchased), 18.4 per cent. Iron and steel material as a whole increased 22.7 per cent in quantity and 14.1 per cent in value.

PRODUCTION OF IRON AND STEEL.

Table 11 shows the total production of all kinds of iron and steel, by census years, with the percentage of increase or decrease.

TABLE 11.—IRON AND STEEL—QUANTITY OF CLASSIFIED PRODUCTS, WITH PER CENT OF INCREASE, BY BRANCHES: 1880 TO 1905.

	QUANTITY (TONS).				PER CENT OF INCREASE.		
	1905	1900	1890	1880	1900 to 1905	1890 to 1900	1880 to 1890
Total	[1] 34,844,933	29,507,860	16,264,478	6,486,733	18.1	81.4	150.8
Blast furnaces	16,628,294	14,452,234	8,845,185	3,375,912	15.1	63.4	162.0
Steel works and rolling mills	[1] 18,211,013	15,040,129	7,388,244	3,046,038	21.1	103.6	142.6
Forges and bloomeries	5,626	15,497	31,049	64,783	[2] 63.7	[2] 50.1	[2] 52.1

[1] Exclusive of 4,184 tons of steel castings made by establishments engaged primarily in the manufacture of other products. [2] Decrease.

The blast furnace products include spiegeleisen, ferromanganese, ferrosilicon, and castings made direct from the blast furnace. Likewise, there is included in the products of steel works and rolling mills the quantity of steel ingots produced for sale. It should be remembered that duplications are necessarily involved, inasmuch as the blast furnace products enter as material into the output of the steel works and rolling mills, and of the forges and bloomeries, and many steel works and rolling mills produce for sale partially finished products, such as muck and scrap bar, billets, slabs, sheet bars, tin plate bars, etc., which figure as material purchased in the reports of other establishments when they are rolled into finished forms. In many instances there is even a second and a third duplication. However, as similar methods of tabulation were employed in previous censuses, the totals are directly comparable.

NUMBER, EQUIPMENT, AND CAPACITY OF IRON AND STEEL ESTABLISHMENTS.

Table 12 shows the number of blast furnaces, steel works and rolling mills, and forges and bloomeries, both active and idle, in the United States in 1905, compared with 1900, 1890, and 1880, and the equipment and capacity of the same.

TABLE 12.—*Iron and steel—active and idle establishments—number, equipment, and capacity: 1880 to 1905.*

	1905	1900	1890	1880
Blast furnaces:				
Number of establishments	265	273	377	483
Number of completed furnaces	435	399	559	681
Total daily capacity, tons of pig iron	87,498	58,569	37,889	17,186
Steel works and rolling mills:				
Number of establishments	[1] 518	476	420	391
Total daily capacity, finished rolled and forged products, tons, double turn	[1] 115,210	90,122	41,576	19,730
Bessemer steel establishments, included above	49	42	51	11
Bessemer steel converters, number	103	91	97	24
Total daily capacity, tons of ingots, double turn	45,427	38,420	19,285	3,988
Open-hearth steel establishments, included above	126	96	58	25
Open-hearth furnaces, number	515	331	129	37
Total daily capacity, tons of ingots, double turn	35,457	19,030	3,608	738
Acid furnaces, number	159	152		
Total daily capacity, tons of ingots, double turn	7,750	6,419		
Basic furnaces, number	356	179		
Total daily capacity, tons of ingots, double turn	27,707	12,611		
Crucible steel establishments, included above	49	40	47	37
Number of pots which can be used at a heat	2,939	2,619	2,606	2,691
Forges and bloomeries:				
Number of establishments	7	14	32	118
Total daily capacity, tons of blooms, billets, and bars, double turn	92	143	263	464

[1] Includes 31 establishments other than steel works and rolling mills. (See Table 13.)

Table 12 includes the establishments classified as "other than steel works and rolling mills," which are given in detail in Table 13.

A concentration of the pig iron industry has continued, as shown by the decrease in number of establishments for each successive census, but the completed furnaces in 1905 show an increase of 36 in number, though at each prior census there was a marked decrease, due chiefly to the dismantling of stacks which were badly located and not equipped for competition with the large modern furnaces. The daily capacity of the furnaces, however, has rapidly increased, the increase being 49.4 per cent from 1900 to 1905, as compared with a decade increase of 54.6 per cent for 1900, and 120.5 per cent for 1890; and in average capacity per furnace there is shown a steady increase from 25 tons per day in 1880 to 68 tons in 1890, 147 tons in 1900, and 201 tons in 1905. The pig iron product for 1905 was 52.1 per cent of the yearly capacity (365 days) of all completed furnaces, as compared with 67.6 per cent in 1900, 64 per cent in 1890, and 53.8 per cent in 1880.

The steel works and rolling mills show an increase in number, and in fact the number of plants is in excess of the number of establishments reported; for, as before explained, in some cases the operations of two or more mills, when under one ownership and within the same municipality or district, are covered by one report. The capacity in finished rolled and forged products of all steel works and rolling mills increased 110.7 per cent for the decade ending 1890, 116.8 per cent for 1900, and 27.6 per cent for the five-year period 1900 to 1905. The average daily capacity per establishment in finished rolled and forged products, double turn, increased from 50 tons in 1880 to 97 tons in 1890, 189 tons in 1900, and 222 tons in 1905.

The tonnage of rolled, forged, and other classified products amounted in 1905 to 52.8 per cent of the yearly capacity of all steel works and rolling mills, computed on the basis of 300 working days, double turn, as compared with 55.6 per cent in 1900, 59.2 per cent in 1890, and 51.5 per cent in 1880.

The output of Bessemer steel, ingots and castings, for 1905, in like manner was 57 per cent of the capacity of all converters for the year (300 days), double turn, as compared with 65.3 per cent in 1900, 62.5 per cent in 1890, and 73.5 per cent in 1880. And the open-hearth

steel products, ingots and castings, was 54.7 per cent of the yearly capacity (300 days) of all open-hearth steel furnaces, on double turn, as compared with 53.3 per cent in 1900. The acid open-hearth furnace product in 1905 was 32.5 per cent of the furnace capacity, as compared with 46.2 per cent in 1900; and the basic open-hearth product was 60.9 per cent of the furnace capacity, against 56.9 per cent in 1900. The crucible steel establishments show a substantial increase in number and in pot capacity.

The establishments referred to as "other than steel works and rolling mills," and which have rolling mill facilities or steel making conveniencies, are given in Table 13. The table shows the number of establishments, the character of the products manufactured, and the equipment and daily capacity, by states.

TABLE 13.—IRON AND STEEL—ESTABLISHMENTS, OTHER THAN STEEL WORKS AND ROLLING MILLS, HAVING STEEL WORKS OR ROLLING MILL EQUIPMENT: 1905.

STATE.	Industry.	Total number of establishments.	STEEL WORKS. Bessemer or modified Bessemer. Number of establishments.	Bessemer: Converters. Number.	Bessemer: Converters. Daily capacity (tons).	Open-hearth. Number of establishments.	Open-hearth: Total. Number of furnaces.	Open-hearth: Total. Daily capacity (tons).	Open-hearth: Acid. Number of furnaces.	Open-hearth: Acid. Daily capacity (tons).	Open-hearth: Basic. Number of furnaces.	Open-hearth: Basic. Daily capacity (tons).	Crucible. Number of establishments.	Crucible. Number of pots.	Crucible. Daily capacity (tons).	Miscellaneous. Number of establishments.	Miscellaneous. Daily capacity (tons).	ROLLING MILLS. Number of establishments.	ROLLING MILLS. Daily capacity (tons).
Total		31	8	11	1,675	6	8	155	6	125	2	30	6	266	24.5	2	10.5	12	825
California	Shipbuilding, iron and steel	1	1	1	8														
Connecticut	Cutlery and edge tools	1														1	3.5	1	14
Delaware	Coppersmithing and sheet iron working	1																1	10
Illinois	Agricultural implements, 2; cars, steam railroad, not including operations of railroad companies, 2; foundry and machine shop products, 2; saws, 1; and wire, 1.	8	2	5	1,627	1	1	10			1	10	2	96	12.0			5	625
Indiana	Agricultural implements, 1; and foundry and machine shop products, 1.	2											1	16	0.5	1	7.0		
Massachusetts	Electrical machinery, apparatus, and supplies, 1; and foundry and machine shop products, 1.	2				1	3	45	3	45			1	100	4.0				
Minnesota	Foundry and machine shop products	1	1	1	4														
New Jersey	Files	1											1	30	5.0				
New York	Agricultural implements	1																1	51
Ohio	Foundry and machine shop products, 2; and iron and steel, bolts, nuts, washers, and rivets (rolling mill department idle), 1.	3	1	1	8	1	1	20			1	20						1	80
Oregon	Foundry and machine shop products	1	1	1	4														
Pennsylvania	Foundry and machine shop products, 5; and tools, not elsewhere specified, 2.	7	1	1	20	3	3	80	3	80								3	45
Virginia	Shipbuilding, iron and steel	1	1	1	[illegible]														
Wisconsin	Electrical machinery, apparatus, and supplies	1											1	24	3.0				

IRON AND STEEL INDUSTRY, BY GEOGRAPHIC DIVISIONS.

Table 14 presents the leading statistics, by geographic divisions for the census years 1880 to 1905, for the industry as a whole and for blast furnaces, and steel works and rolling mills, with forges and bloomeries combined with the latter for comparative purposes.

The New England states include Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut; the Middle states, New York, New Jersey, Pennsylvania, and Delaware; the Southern states, Maryland, Virginia, District of Columbia, West Virginia, North Carolina, Georgia, Alabama, Kentucky, Tennessee, and Texas; and the Western states, Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, Nebraska, Kansas, Colorado, Wyoming, Oregon, Washington, and California. All of these states produced iron and steel during one or more of the years covered by the table. The states of New Hampshire, Vermont, North Carolina, Iowa, Nebraska, and Wyoming, and the District of Columbia, do not appear as producers in 1905.

The forges and bloomeries, combined with steel works and rolling mills in the above table, include establishments distributed at the several censuses as follows: In 1905, 6 establishments, of which 5 were in the Middle states and 1 in the Southern states; in 1900, 7 establishments, of which 6 were in the Middle states and 1 in the Southern states; in 1890, 20 establishments, of which 19 were in the Middle states and 1 in the Southern states; and in 1880, 93 establishments, of which 1 was in New England, 53 in the Middle states, 36 in the Southern states, and 3 in the Western states.

Each of the geographic divisions shows a gain, whether measured by investment of capital, by wage-earners employed, or by tonnage or value of products. A decrease in number of establishments is found in all of the divisions except in New England, where there is an increase of 2.

In connection with Table 14 there is presented Table 15, which shows the per cent of increase of the several items of inquiry for the industry as a whole and the two branches thereof, by geographic divisions, for each census year, 1880 to 1905; also Table 16, which shows the per cent of the total capital and products, value and quantity, by geographic divisions, for each census year.

TABLE 14.—IRON AND STEEL—COMPARATIVE SUMMARY, BY BRANCHES AND GEOGRAPHIC DIVISIONS: 1880 TO 1905.

DIVISION.	Census.	Number of establishments.	Capital.	Salaried officials, clerks, etc.		Wage-earners and wages.		Miscellaneous expenses.	Cost of materials used.	Value of products.	Tons of products.
				Number.	Salaries.	Average number.	Wages.				
		TOTAL.									
United States	1905	606	[1] $948,689,840	16,566	$20,758,412	242,740	$141,439,906	$47,164,970	$620,171,881	[2] $905,854,152	[2] 34,844,933
	1900	669	[1] 590,530,484	9,217	11,741,788	222,607	120,836,338	32,274,100	522,431,701	804,034,918	29,507,860
	1890	719	[1] 414,044,844	[3] 4,325	[3] 6,462,236	171,181	89,273,956	18,214,948	327,272,845	478,687,519	16,264,478
	1880	792	209,904,965	(4)	(4)	140,798	55,451,510	(5)	191,271,150	296,557,685	6,486,733
New England states	1905	20	28,108,576	579	612,293	8,262	4,547,082	1,357,606	10,642,371	18,965,450	281,809
	1900	18	21,778,391	187	305,046	8,248	4,515,060	1,224,618	10,141,357	18,303,510	203,265
	1890	32	13,224,150	199	297,157	6,645	3,224,318	413,578	9,286,050	15,105,441	216,643
	1880	49	10,490,408	(4)	(4)	8,654	3,357,911	(5)	9,518,570	14,558,627	190,161
Middle states	1905	306	594,663,982	10,394	13,081,653	144,019	83,495,490	29,734,702	360,100,463	526,355,772	19,189,532
	1900	352	359,821,693	5,719	7,192,690	126,060	69,569,423	19,636,385	308,765,127	475,845,093	16,111,525
	1890	390	256,833,069	2,484	3,747,602	106,108	56,166,425	11,324,830	199,225,674	294,048,406	9,475,941
	1880	439	132,814,213	(4)	(4)	75,055	31,348,225	(5)	113,432,592	180,484,560	4,011,380
Southern states	1905	96	66,448,061	1,096	1,355,797	22,593	10,639,628	2,791,143	50,272,050	71,028,747	3,925,784
	1900	97	46,089,040	719	989,800	21,890	8,560,814	2,299,084	41,133,966	33,771,161	3,468,680
	1890	109	43,051,652	550	806,415	17,051	6,863,185	2,110,129	27,047,767	39,982,152	2,051,057
	1880	130	21,912,311	(4)	(4)	19,728	5,916,868	(5)	13,739,624	23,006,074	549,317
Western states	1905	184	259,469,221	4,497	5,708,669	67,866	42,757,706	13,281,519	199,156,997	289,504,183	11,447,808
	1900	202	162,841,360	2,592	3,254,252	66,409	38,191,041	9,114,013	162,391,251	246,115,154	9,724,390
	1890	188	100,935,973	1,092	1,611,062	41,377	23,020,028	4,366,411	91,713,354	129,551,520	4.520,837
	1880	174	44,688,033	(4)	(4)	37,361	14,828,506	(5)	54,580,364	78,508,424	1,735,875
		BLAST FURNACES.									
United States	1905	191	$239,559,194	2,236	$2,897,917	35,178	$18,947,913	$9,791,139	$178,967,449	$231,889,126	16,628,294
	1900	224	148,226,113	1,763	2,308,420	39,358	18,500,462	7,463,234	131,536,424	206,823,202	14,452,234
	1890	304	134,608,543	1,068	1,611,687	33,415	14,614,458	6,342,675	110,098,615	145,643,153	8,845,185
	1880	341	89,531,362	(4)	(4)	41,695	12,655,428	(5)	58,619,742	89,315,569	3,375,912
New England states	1905	3	418,787	8	15,000	83	39,800	24,287	308,405	451,448	16,267
	1900	2	323,234	7	9,500	69	27,414	21,940	201,885	330,375	13,487
	1890	7	1,751,253	18	24,547	198	76,034	110,073	634,052	886,438	30,657
	1880	10	1,974,000	(4)	(4)	855	288,959	(5)	677,862	1,042,896	27,640
Middle states	1905	79	129,917,064	999	1,314,816	16,200	9,295,861	5,079,628	95,636,218	119,691,515	8,601,174
	1900	95	81,328,706	704	912,961	17,697	8,962,622	3,648,228	69,590,971	109,167,847	7,263,098
	1890	140	68,896,144	422	674,974	17,662	7,905,567	3,163,843	63,115,306	82,650,533	4,782,932
	1880	179	53,969,265	(4)	(4)	17,152	6,021,406	(5)	36,330,367	55,818,738	2,143,833
Southern states	1905	53	35,747,617	579	674,190	9,211	3,647,488	1,281,121	24,214,762	32,821,888	2,728,258
	1900	64	27,010,584	441	597,267	10,747	3,193,014	1,443,414	21,150,098	33,576,226	2,604,510
	1890	73	29,974,471	332	499,120	7,932	2,917,158	1,578,512	15,410,982	22,494,870	1,638,022
	1880	59	11,890,907	(4)	(4)	9,486	2,186,855	(5)	4,452,864	7,769,050	312,890
Western states	1905	56	73,475,726	650	893,911	9,684	5,964,764	3,406,103	58,808,064	78,924,275	5,282,595
	1900	63	39,563,589	611	788,692	10,845	6,317,412	2,349,652	40,593.470	63,748,754	4,571,139
	1890	84	33,986,675	296	413,046	7,623	3,715,699	1,490,247	30,938,275	39,611,312	2,393,574
	1880	93	21,697,190	(4)	(4)	14,202	4,158,208	(5)	17,158,649	24,684,885	891,549
		STEEL WORKS AND ROLLING MILLS, AND FORGES AND BLOOMERIES.									
United States	1905	415	$709,130,646	14,330	$17,860,495	207,562	$122,491,993	$37,373,831	$441,204,432	[2] $673,965,026	[2] 18,216,639
	1900	445	442,304,371	7,454	9,433,368	183,249	102,335,876	24,810,866	390,895,277	597,211,716	15,055,626
	1890	415	279,436,301	3,257	4,850,549	137,766	74,659,498	11,872,273	217,174,230	333,044,366	7,419,293
	1880	451	120,373,603	(4)	(4)	99,103	42,796,082	(5)	132,651,408	207,242,116	3,110,821
New England states	1905	17	27,689,789	571	597,293	8,179	4,507,282	1,333,319	10,333,966	18,514,002	265,542
	1900	16	21,455,157	180	295,546	8,179	4,487,646	1,202,678	9,939,472	17,973,135	189,778
	1890	25	11,472,897	181	272,610	6,447	3,148,284	303,505	8,651,998	14,219,003	185,986
	1880	39	8,516,408	(4)	(4)	7,799	3,068,952	(5)	8,840,708	13,515,731	162,521
Middle states	1905	227	464,746,918	9,395	11,766,837	127,819	74,199,629	24,655,074	264,464,245	406,664,257	10,588,358
	1900	257	278,492,987	5,015	6,279,729	108,363	60,606,801	15,988,157	239,174,156	366,677,246	8,848,427
	1890	250	187,936,925	2,062	3,072,628	88,446	48,260,858	8,160,987	136,110,368	211,397,873	4,693,009
	1880	260	78,844,948	(4)	(4)	57,903	25,326,819	(5)	77,102,225	124,665,822	1,867,547
Southern states	1905	43	30,700,444	517	681,607	13,382	6,992,140	1,510,022	26,057,288	38,206,859	1,197,526
	1900	33	19,078,456	278	392,533	11,143	5,367,800	855,670	19,983,868	30,194,935	864,170
	1890	36	13,077,181	218	307,295	9,119	3,946,027	531,617	11,636,785	17,487,282	413,035
	1880	71	10,021,404	(4)	(4)	10,242	3,730,013	(5)	9,286,760	15,237,024	236,427
Western states	1905	128	185,993,495	3,847	4,814,758	58,182	36,792,942	9,875,416	140,348,933	210,579,908	6,165,213
	1900	139	123,277,771	1,981	2,465,560	55,564	31,873,629	6,764,361	121,797,781	182,366,400	5,153,251
	1890	104	66,949,298	796	1,198,016	33,754	19,304,329	2,876,164	60,775,079	89,940,208	2,127,263
	1880	81	22,990,843	(4)	(4)	23,159	10,670,298	(5)	37,421,715	53,823,539	844,326

1 Includes value of rented property—1905, $12,106,619; 1900, $16,968,821; 1890, $8,273,058.
2 Exclusive of 4,184 tons of steel castings, valued at $347,264, made by establishments engaged primarily in the manufacture of other products.
3 Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905, but not included in this table.
4 Not reported separately.
5 Not reported.

TABLE 15.—IRON AND STEEL—PER CENT OF INCREASE IN PRINCIPAL

	DIVISION.	Intercensal period.	PER CENT OF INCREASE. Total. Capital.	Salaried officials, clerks, etc. Number.	Salaried officials, clerks, etc. Salaries.	Wage-earners and wages. Average number.	Wage-earners and wages. Wages.	Miscellaneous expenses.	Cost of materials used.	Value of products.	Tons of products.
1	United States	1900 to 1905	60.7	79.7	76.8	9.0	17.1	46.1	18.7	12.7	18.1
2		1890 to 1900	42.6	113.1	81.7	30.0	35.4	77.2	59.6	68.0	81.4
3		1880 to 1890	97.3			21.6	61.0		71.1	61.4	150.7
4	New England states	1900 to 1905	29.1	209.6	100.7	0.2	0.7	10.9	4.9	3.6	38.6
5		1890 to 1900	64.7	[1]6.0	2.7	24.1	40.0	196.1	9.2	21.2	[1]6.2
6		1880 to 1890	26.1			[1]23.2	[1]4.0		[1]2.4	3.8	13.9
7	Middle states	1900 to 1905	65.3	81.7	81.9	14.2	20.0	51.4	16.6	10.6	19.1
8		1890 to 1900	40.1	130.2	91.9	18.8	23.9	73.4	55.0	61.8	70.0
9		1880 to 1890	93.4			41.4	79.2		75.6	62.9	136.2
10	Southern states	1900 to 1905	44.2	52.4	37.0	3.2	24.3	21.4	22.2	11.4	13.2
11		1890 to 1900	7.1	30.7	22.7	28.4	24.7	9.0	52.1	59.5	69.1
12		1880 to 1890	96.2			[1]13.6	16.0		96.9	73.8	273.4
13	Western states	1900 to 1905	59.3	73.5	75.4	2.2	12.0	45.7	22.6	17.6	17.7
14		1890 to 1900	61.3	137.4	102.0	60.5	65.9	108.7	77.1	90.0	115.1
15		1880 to 1890	126.0			10.7	55.2		68.0	65.0	160.4

[1] Decrease.

ITEMS, BY BRANCHES AND GEOGRAPHIC DIVISIONS: 1880 TO 1905.

PER CENT OF INCREASE—continued.																		
Blast furnaces.									Steel works and rolling mills, and forges and bloomeries.									
Capital.	Salaried officials, clerks, etc.		Wage-earners and wages.		Miscellaneous expenses.	Cost of materials used.	Value of products.	Tons of products.	Capital.	Salaried officials, clerks, etc.		Wage-earners and wages.		Miscellaneous expenses.	Cost of materials used.	Value of products.	Tons of products.	
	Number.	Salaries.	Average number.	Wages.						Number.	Salaries.	Average number.	Wages.					
61.6	26.8	25.5	[1]10.6	2.4	31.2	36.1	12.1	15.1	60.3	92.3	89.3	13.3	19.7	50.6	12.9	12.9	21.0	1
10.1	65.1	43.2	17.8	26.6	17.7	19.5	42.0	63.4	58.3	128.9	94.5	33.0	37.1	109.0	80.0	79.3	102.9	2
50.3	....	....	[1]19.9	15.5	....	87.8	63.1	162.0	132.1	....	....	39.0	74.5	....	63.7	60.7	138.5	3
29.6	14.3	57.9	20.3	45.2	10.7	52.8	36.6	20.6	29.1	217.2	102.1	....	0.4	10.9	4.0	3.0	39.9	4
[1]81.5	[1]61.1	[1]61.3	[1]65.2	[1]64.0	[1]80.1	[1]68.2	[1]62.7	[1]56.0	87.0	[1]0.6	8.4	26.9	42.5	296.3	14.9	26.4	2.0	5
[1]11.3	....	....	[1]76.8	[1]73.7	....	[1]6.5	[1]15.0	10.9	34.7	....	....	[1]17.4	2.6	....	[1]2.1	5.2	14.4	6
59.7	41.9	44.0	[1]8.5	3.7	39.2	37.4	9.6	18.4	66.9	87.3	87.4	18.0	22.4	54.2	10.6	10.9	19.7	7
18.0	66.8	35.3	0.2	13.4	15.3	10.3	32.1	51.9	48.2	143.2	104.4	22.5	25.6	95.9	75.7	73.5	88.5	8
27.7	....	....	3.0	31.3	....	73.7	48.1	123.1	138.4	....	....	52.7	90.6	....	76.5	69.6	151.3	9
32.3	31.3	12.9	[1]14.3	14.2	[1]11.2	14.5	[1]2.2	4.8	60 9	86.0	73.6	20.1	30.3	76.5	30.4	26.5	38.6	10
[1]9.9	32.8	19.7	35.5	9.5	[1]8.6	37.2	49.3	59.0	45.9	27.5	27.7	22.2	36.0	61.0	71.7	72.7	109.2	11
151.4	....	....	[1]16.4	33.4	....	246.1	189.5	423.5	30.5	....	....	[1]11.0	5.8	....	25.3	14.8	74.7	12
85.7	6.4	13.3	[1]10.7	[1]5.6	45.0	44.9	23.8	15.6	50.9	94.2	95.3	4.7	15.4	46.0	15.2	15.5	19.6	13
16.4	106.4	90.9	42.3	70.0	57.7	31.2	60.9	91.0	84.1	148.9	105.8	64.6	65.1	135.2	100.4	102.8	142.2	14
56.6	....	....	[1]46.3	[1]10.6	....	80.3	60.5	168.5	191.2	....	....	45.7	80.9	....	62.4	67.1	151.9	15

TABLE 16.—IRON AND STEEL—PER CENT OF TOTAL CAPITAL AND PRODUCTS, BY BRANCHES AND GEOGRAPHIC DIVISIONS: 1880 TO 1905.

DIVISION.	Census.	PER CENT OF TOTAL.								
		Capital.			Products.					
					Value.			Tons.		
		Total.	Blast furnaces.	Steel works and rolling mills, and forges and bloomeries.	Total.	Blast furnaces.	Steel works and rolling mills, and forges and bloomeries.	Total.	Blast furnaces.	Steel works and rolling mills, and forges and bloomeries.
United States		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
New England states	1905	3.0	0.2	3.9	2.1	0.2	2.8	0.8	0.1	1.5
	1900	3.7	0.2	4.8	2.3	0.2	3.0	0.7	0.1	1.3
	1890	3.2	1.3	4.1	3.1	0.6	4.3	1.3	0.3	2.5
	1880	5.0	2.2	7.1	4.9	1.2	6.5	2.9	0.8	5.3
Middle states	1905	62.7	54.2	65.6	58.1	51.6	60.3	55.1	51.7	58.1
	1900	60.9	54.9	63.0	59.2	52.8	61.4	54.6	50.3	58.8
	1890	62.0	51.2	67.2	61.4	56.8	63.5	58.3	54.1	63.2
	1880	63.3	60.3	65.5	60.9	62.5	60.2	61.8	63.5	60.0
Southern states	1905	7.0	14.9	4.3	7.8	14.2	5.7	11.3	16.4	6.6
	1900	7.8	18.2	4.3	7.9	16.2	5.1	11.7	18.0	5.7
	1890	10.4	22.3	4.7	8.4	15.4	5.2	12.6	18.5	5.6
	1880	10.4	13.3	8.3	7.7	8.7	7.3	8.5	9.3	7.6
Western states	1905	27.3	30.7	26.2	32.0	34.0	31.2	32.8	31.8	33.8
	1900	27.6	26.7	27.9	30.6	30.8	30.5	33.0	31.6	34.2
	1890	24.4	25.2	24.0	27.1	27.2	27.0	27.8	27.1	28.7
	1880	21.3	24.2	19.1	26.5	27.6	26.0	26.8	26.4	27.1

At each census the Middle states or division has ranked first; the Western, second; the Southern, third; and the New England, fourth, with respect to capital, average number of wage-earners, and products, whether measured by value or quantity, in the industry as a whole and in each of the branches; excepting that in 1900 the New England states ranked third in capital invested in steel works, rolling mills, forges and bloomeries, and the Southern, fourth; and in 1890 the Southern ranked second in average number of wage-earners and the Western, third.

In the matter of absolute increase in the principal items for the census period 1900 to 1905, the geographic divisions rank in the same order, the increase in capital ranging from an increase of $234,842,289 in the Middle states, as deduced from Table 14, to an increase of $6,330,185 in the New England states; and in products, from an increase of $50,510,679 in value and 3,078,007 tons in quantity in the Middle states to an increase of $661,940 in value and 78,544 tons in quantity in the New England states.

The rates of increase and the proportions of the totals of capital and products presented in Tables 15 and 16, respectively, have varied, however, very materially. For the period 1880 to 1890 capital increased at the greatest rate in the Western division, with the Southern second in this respect, and the Middle third. In the case of products the Southern division showed the greatest rate of increase, with the Western second and the Middle third. The growth in the Southern division during the period was chiefly in the pig iron industry, and the ratio of increase therein largely exceeded that of the other divisions. In the steel works and rolling mills branch of the industry, including forges and bloomeries, the rates of increase in the Middle and Western divisions were approximately the same and much greater than in the Southern division. During this census period the increase in New England was small and confined to the steel works and rolling mills; blast furnaces showing a decrease for all items except in tonnage of pig iron.

For the census period 1890 to 1900 the proportionate increase in capital was largest in the New England states and all in the steel works and rolling mills section. The Western division was next, and had the largest increase in products in the industry as a whole and in both of its branches, followed by the Middle division and then by the Southern.

For the census period 1900 to 1905, ignoring the New England division, which shows large proportionate increase in tonnage of products though the quantity is small, the Middle division shows the greatest rate of increase both in capital and in tonnage of products, followed by the Western and then by the Southern; while the Western division leads in this respect in value of products. In each case the rate of increase is greatest in the steel works and rolling mills branch of the industry. It will be seen by reference to Table 16 that during the twenty-five years since 1880 the proportionate share of the total capital invested has largely increased for the Western division for both branches of the industry; in the Southern division it has increased for blast furnaces and decreased for steel works and rolling mills and the industry as a whole; and in the Middle division it is practically unchanged for steel works and rolling mills and has

decreased for blast furnaces and the industry as a whole. In the matter of products the proportionate share of the Western division has increased in value and quantity for the industry as a whole and in both departments; the Southern division has increased its proportionate share of blast furnace products and for the industry as a whole, with a decrease in the proportion of the products of steel works and rolling mills; while the Middle division shows a material proportionate decrease in the tonnage and value of products for blast furnaces and the industry as a whole, with a small decrease in the proportionate share of the tons of products of steel works and rolling mills and a slight increase in value. In general, Tables 15 and 16 show for the quarter of a century a more rapid growth in the Western and Southern states, and in the case of the former group a material increase in relative importance.

The following tabular statement shows the percentage of the products both as to value and quantity, contributed by the two branches of the industry, by geographic divisions, for each census from 1880 to 1905:

Per cent of total value and quantity of products, by branches and geographic divisions: 1880 to 1905.

DIVISION.	Census.	VALUE.		TONS.	
		Blast furnaces.	Steel works and rolling mills, and forges and bloomeries.	Blast furnaces.	Steel works and rolling mills, and forges and bloomeries.
United States	1905	25.6	74.4	47.7	52.3
	1900	25.7	74.3	49.0	51.0
	1890	30.4	69.6	54.4	45.6
	1880	30.1	69.9	52.0	48.0
New England states	1905	2.4	97.6	5.8	94.2
	1900	1.8	98.2	6.6	93.4
	1890	5.9	94.1	14.2	85.8
	1880	7.2	92.8	14.5	85.5
Middle states	1905	22.7	77.3	44.8	55.2
	1900	22.9	77.1	45.1	54.9
	1890	28.1	71.9	50.5	49.5
	1880	30.9	69.1	53.4	46.6
Southern states	1905	46.2	53.8	69.5	30.5
	1900	52.7	47.3	75.1	24.9
	1890	56.3	43.7	79.9	20.1
	1880	33.8	66.2	57.0	43.0
Western states	1905	27.3	72.7	46.1	53.9
	1900	25.9	74.1	47.0	53.0
	1890	30.6	69.4	52.9	47.1
	1880	31.4	68.6	51.4	48.6

For the United States as a whole the products of the steel works and rolling mills constitute approximately three-fourths of the total in value and the blast furnace products one-fourth, and there has been in the main an increase in the proportionate share for steel works and rolling mills with each census. The same may also be said of the Middle and Western states. In the Southern states the blast furnace products form nearly one-half of the total in value and more than two-thirds in tonnage. In 1890, as compared with 1880, there was a very heavy increase in the blast furnace industry in the Southern states, as compared with steel works and rolling mills, since which time the products of the steel works and rolling mills have been gaining on the blast furnaces. In the New England states the blast furnace products form but a small part of the combined total.

The New England states.—In the New England states there is shown a substantial increase in capital since 1900, practically all in steel works and rolling mills; likewise, large increases for the decades ending in 1900 and 1890.

The products of the steel works and rolling mills have increased with each census, and the proportionate share of the total for the United States has slightly increased in tonnage since 1900, although slightly decreasing in proportionate value.

The pig iron product is all charcoal pig.

The 17 establishments in the New England states in 1905 engaged in the manufacture of steel or of rolled iron or steel products do not include 3 establishments otherwise classified, and whose products were all consumed in construction of machinery, etc. The capital invested in the active establishments includes $325,000 of rented property in 1905 and $115,000 of rented property in 1890.

Since the census of 1900 the New England states have become steel producers. There are 9 establishments in Massachusetts, Rhode Island, and Connecticut having steel making equipments, including 2 establishments in Massachusetts otherwise classified, 1 as "foundry and machine shop products," and 1 as "electrical machinery," and 1 in Connecticut classified as "cutlery and edge tools;" but not including 1 governmental establishment. The steel equipment of these establishments includes 3 converters of a daily capacity of 208 tons, including 1 Clapp-Griffiths and 2 Tropenas converters (the Government establishment has 1 Tropenas converter) and 20 open-hearth steel furnaces of 1,095 tons daily capacity, of which 10, of 365 tons daily capacity, are acid, and 10, of 730 tons daily capacity, are basic. Of the open-hearth furnaces, 3 acid furnaces, of 45 tons daily capacity, are in the "otherwise classified" industries. The tabulated steel output of the New England states in 1905 was 300 tons of Bessemer steel ingots; 168,928 tons of open-hearth steel ingots, of which 33,774 tons were acid and 135,154 tons were basic; 2,446 tons of open-hearth steel castings; and 4,778 tons of crucible steel. The total product was 176,452 tons of steel, of a value of $3,963,006.

The Middle states.—The Middle states show a decrease of 46 in the number of establishments, with an increase of $234,842,289, or 65.3 per cent, in capital since 1900, the largest in amount and per cent of any of the divisions for this period. The increase is relatively a little the larger in steel works and rolling mills.

The total number of active blast furnace establishments in the Middle states in 1905 was 79, compared

with 95 in 1900, 140 in 1890, and 179 in 1880. The capital invested includes rented property valued at $2,116,480 in 1905, $3,165,181 in 1900, and $2,210,000 in 1890. The reduction in number of wage-earners employed in the blast furnace industry is due to improvements in equipment, chiefly in the use of pig casting machines and in improved charging and ore handling devices. Of the pig product, 32,704 tons were charcoal pig iron and 8,568,470, mineral fuel pig.

In addition to the 227 establishments in the Middle states that produced steel ingots or castings or rolled iron and steel in 1905, there were 10 establishments otherwise classified. The distribution and equipment of the latter are shown in Table 13. The capital invested in active establishments includes $7,741,886 of rented property in 1905, $10,564,736 in 1900, and $978,000 in 1890.

The Southern states.—The Southern states show a decrease of 11 blast furnace establishments and an increase of 10 steel works and rolling mills, making a net decrease of 1. The increase in the number of wage-earners is relatively small, owing to the fact that in the Southern states the blast furnace branch forms a relatively larger part of the iron and steel industry than in the other divisions, and the improvements in blast furnace equipment have materially reduced the number of wage-earners required.

The capital reported for the furnace establishments in the Southern states includes rented property of the value of $251,500 in 1905, $460,500 in 1900, and $783,000 in 1890.

The steel works and rolling mills in the Southern states do not include 1 establishment classified as "shipbuilding, iron and steel," and having a Tropenas converter, the steel product being used in their works. There is included in invested capital for steel works and rolling mills the value of rented property as follows: $714,000 in 1905, $957,313 in 1900, and $500,000 in 1890.

The steel production of the Southern states in 1905 amounted to 841,671 tons, of a value of $15,302,150. This comprised 607,343 tons of Bessemer steel (606,166 tons of ingots and 1,177 castings), 233,152 tons of basic open-hearth steel ingots, 570 tons of basic open-hearth steel castings, 6 tons of crucible steel ingots, and 600 tons of crucible steel castings. The 10 establishments in the Southern states which are equipped for steel making have 10 Bessemer converters of a daily capacity of 4,460 tons and 21 open-hearth steel furnaces of a daily capacity of 1,496 tons. Of the open-hearth furnaces, 20 are basic and 1 acid. The figures do not include the equipment of 1 establishment otherwise classified, nor one 2-gross ton Tropenas steel converter at the Naval Gun Factory, Washington, District of Columbia.

The Western states.—The value of the rented property included in the amount of capital reported for the Western states was $957,753 in 1905, $1,821,091 in 1900, and $3,687,058 in 1890. The value of the rented property was distributed as follows: In blast furnaces, $790,303 in 1905, $1,271,200 in 1900, and $2,068,058 in 1890; and in steel works and rolling mills, $167,450 in 1905, $549,891 in 1900, and $1,619,000 in 1890.

There were also 17 establishments otherwise classified in the Western states in 1905 which were provided with equipments for the making of steel or rolled iron and steel products for their own use. Four of these establishments reported the manufacture of 3,608 tons of steel as partial products. The distribution and classification of these is given in Table 13.

THE ELECTROTHERMIC METALLURGY OF IRON AND STEEL.

In addition to the iron and steel products which have been considered, certain of the ferroalloys—ferrochrome, ferrosilicon, etc.—were produced by the Electric Smelting and Aluminum Company (The Cowles Company) of Lockport, N. Y., and the Willson Aluminum Company with plants at Holcombs Rock, Va., and Glen Ferris, W. Va. These products are used in the steel industry as steel hardening materials. The statistics relating to these products can not be reported separately, and they are therefore consolidated with those of like products of the electric furnace, such as calcium carbide, carborundum, etc., and reported under the group of "substances produced by the aid of electricity," Group VIII of the report on chemicals.

Except in the ferro products above referred to, the electric furnace does not figure in the census of 1905 as a producing agent in the iron and steel industry. It is likely, however, to become an important feature of the iron and steel metallurgy of the future.

The Héroult furnace has been operated at La Praz, France, and at Kortfors, Sweden, since 1900, and over 5,000 tons of steel have been produced. Extensive tests of the manufacture of pig iron in the Héroult furnace were made during the last year at Sault Ste. Marie, Ontario, under the auspices of a commission appointed by the Canadian government. The Kjellin furnace has been operated at Gysingen, near Stockholm, Sweden, since 1901, and several thousand tons of high grade steel have been produced. The Keller furnace has been operated quite extensively at the works of Keller, Leleux & Co., at Livet and at Kerrousse, France. The Stassano furnace has produced steel in the government gun foundry at Turin, Italy.

Since the close of the canvass for the manufacturing census of 1905 there has been considerable activity in the field of electric smelting. The Héroult electric steel refining process, in a 50-ton per day furnace, has been installed at the works of the Holcomb Steel Company, Syracuse, N. Y., and an electric induction steel furnace (Colby) at the works of Henry Disston & Sons, Philadelphia.

The Virginia Electrolytic Company at Holcombs Rock, Va., an offshoot of the Willson Aluminum Company, now makes ferroalloys and metallic silicon, the Willson Aluminum Company at Glen Ferris, Va., making principally ferrochrome. Considerable quantities of the ferroalloys have also been made in the Niagara Research Laboratories, Niagara Falls, N. Y., and an outcome of this work is the formation in 1907 of the Electro Metallurgical Company for making low carbon ferroalloys at Niagara Falls. The Titanium Manufacturing Company is also erecting works at Niagara Falls for making ferrotitanium.

As a result of the experimental work in iron smelting at Sault Ste. Marie, the Noble Electric Steel Company is erecting a Héroult electric furnace plant for reduction of iron ore at Héroult-on-the-Pitt, Shasta county, Cal. At Newmire, Colo., reduction works have been started by the Vanadium Alloys Company for the production of vanadate of iron and ferrovanadium.

The salient features of the several types of electric furnaces which have been used commercially are as follows:

The Héroult electric furnace, as used for the experimental smelting of iron ore at Sault Ste. Marie, Ontario, consists of a short cylindrical stack having a carbon-lined crucible hearth connected with one circuit terminal, and a massive carbon electrode adjustably suspended from above and extending down into the furnace chamber. The carbon electrode used was 16 by 16 inches by 6 feet long and the furnace chamber was approximately 30 inches in diameter.

The Héroult furnace, as used for steel making, is of the tilting open-hearth type. Two massive electrodes, carried by vertically adjustable supports which are attached to the furnace structure, pass through the roof of the furnace. The current passes from one electrode through an air gap to the slag, through this to the underlying molten metal, thence through the latter and back through the slag and the air gap to the other electrode. It thus forms two arc fields between the slag and the respective electrodes. The intensity of the current is controlled by regulating the gap between the electrodes and the slag.

The Kjellin furnace, as operated at Gysingen, Sweden, is of the induction type, using a primary alternating current of 90 amperes and 3,000 volts and developing in the charge, which is in an annular pocket, a current of 3,000 amperes at 7 volts. In its present form the furnace permits of tipping for pouring the charge. The product is an exceptionally pure steel akin to crucible steel.

The Keller furnace for ore smelting is of the resistance type, and consists in general of two or more shafts connected at the bottom by a lateral canal, which widens out midway between the shafts to form a reservoir, or hearth, for the molten metal. Each shaft has a massive carbon electrode extending down from above, and the charge is fed progressively into the shafts around the electrodes. The molten metal is tapped from the reservoir, or hearth, and the slag is tapped from each shaft at a higher level than the reservoir tap. Certain structural features govern the starting of the furnace. The resistance of the charge develops its heat of fusion, and the reduced metal, flowing along the canal, conducts the current from one shaft to the other.

The Stassano furnace is of the arc type, a 3-phase alternating current being distributed to 3 electrodes which pass into the furnace radially and at an angle inclined slightly downward, and nearly meet in the center above the charge, which is not in circuit. The furnace, its hearth being of a crucible form, stands with its vertical axis inclined about 7 degrees from the vertical, and when in operation the whole furnace is rotated to mix the charge and subject all parts thereof to a uniform heat.

Certain results, as given in the report of the Canadian commission on the electric smelting of iron ores, are as follows: Pig iron (gray iron) to the amount of 11,989 pounds was produced from magnetite ore (55.85 Fe), with charcoal as the reducing agent and limestone and sand as flux, at the rate of 9.92 short tons of pig per 1,000 electric horsepower days. The power used was 221.34 electric horsepower (mean amperes, 4,987; mean volts on furnace, 36.03) and the length of the run was sixty-five hours and thirty minutes. It is stated by Doctor Héroult that an output of 12 tons of pig iron per day may be obtained with 1,000 electric horsepower. On a run on roasted pyrrhotite (45.80 Fe), with charcoal and limestone as above, there was produced 7,336 pounds of ferronickel pig at the rate of 7.038 short tons per 1,000 electric horsepower days. The power used was 222.05 electric horsepower (mean amperes, 5,000; mean volts on furnace, 36.05) and the length of the run was fifty-six hours and twenty-nine minutes.

A description of the Héroult electric steel process, as introduced at the works of Richard Lindenberg, Remscheid, Germany, is given in the Iron Age of August 30, 1906. The plant consists of a 2-ton Wellman open-hearth furnace, in which the raw material, principally scrap, is melted down, and the process is so conducted that the steel is overoxidized. The steel is then transferred to the Héroult electric furnace. The quantity charged is about 2 tons, and the steel is purified in the electric furnace by the addition of scale or ore, and thus the elements in the metals, such as silicon, carbon, manganese, and phosphorus, are oxidized; sulphur, however, is not so affected. The slag is cast off by tilting the furnace. Then a neutral slag is formed by additions of lime and sand, under which deoxidation is carried on by means of carbon. The yield is on an average 92.5 per cent in the form of hammered blooms.

The phosphorus contents of the steel has averaged 0.005 per cent and the sulphur, 0.012 per cent.

Experience has shown that with a 2-ton furnace the cost of steel can be reduced to 120 marks ($30) per ton, and it is estimated that with a 10-ton furnace it can be brought down to 90 marks ($22.50) per ton. With the 2-ton furnace the requirement of electric power is 360 kilowatts per ton of steel, and with a 10-ton furnace only 150 kilowatts will be required.

In a paper by S. E. Ibbotson, of Sheffield, read at the joint meeting of the Iron and Steel Institute and of the American Institute of Mining Engineers, in London, July, 1906, on the operations of the Kjellin electric steel furnace, it was stated that there was produced during the year ending May 31, 1906, at Gysingen, Sweden, 950 tons of tool steel and special steel ingots from a furnace giving 2,240 pounds of steel per tap. The bulk of the steel was made from charges composed of 80 per cent Swedish pig iron and 20 per cent steel scrap, the percentage of carbon being regulated by the addition of briquettes. The average time per charge for white iron and scrap charges was five and one-half hours and the electrical energy consumed was 886 kilowatt hours per ton. When briquettes were added, the average time per charge was seven and one-eighth hours and the electrical energy consumed was 1,128 kilowatt hours per ton.

In the line of special steels there has been produced tungsten steel (including permanent magnet steel), chromium steel, nickel steel, nickel-chromium steel, self-hardening steel, and high-speed tool steel.

A 736-kw, or approximately 1,000 electric horsepower tilting Kjellin furnace for steel manufacture has lately (1907) been completed at the Roechling iron and steel works in Voelklingen, Germany. It has a capacity of 24 tons of steel, 15 tons being poured at the end of the run, the balance remaining in the furnace for the next run. The following extract from a recent publication is of interest in this connection:[1]

An interesting and quite novel feature of the same plant is a fourth induction furnace now in course of construction. It has a capacity of 150 tons, but is not intended for steel making and refining proper, but will be used as a mixer and reservoir to keep the hot molten metal, which is tapped from the ordinary metallurgical furnaces and which is to be refined in the electric furnace, in molten condition. From this reservoir molten metal is to be run into the electric furnace right after the completion of a run, so as to maintain as much as possible continuity of operation.

In this connection it is interesting to give a summary of electric induction furnaces installed for commercial operation. In this country we have a Colby induction furnace at the Disston Steel Works in Philadelphia. In Europe the following Kjellin induction furnaces have been installed:

Gysingen, Sweden: 150 kw., 955 kg. (2,100 pounds). This is the original Kjellin furnace.

Gurtnellen, Switzerland: International Calcium Co., 320 kw.

Voelklingen, Germany: Roechling Works. Of the following four furnaces the first three are in operation, the fourth in course of construction: First, 50 to 75 kw., capacity 50 to 60 kg. (110 to 130 pounds); second, 110 to 120 kw., capacity 300 kg. (660 pounds); third, 736 kw., pour 15 tons (15,000 kg., or 33,000 pounds); fourth, a 150-ton mixer to keep the metal molten.

Essen, Germany: Krupp Works, 746 kw.

Sheffield, England: Vickers, Sons & Maxim, 200 kg.

Araga, Spain: 200 kw.

There are further in course of construction a 300 to 400 kw. furnace at Guldsmedshyttan, Sweden, and another furnace of the same capacity at Poldihutte.

From the above figures for the furnaces at Gysingen and Voelklingen the following interesting figures on the relation between capacity of furnace and required electric capacity are derived:

Capacity in kg. steel	50 to 60	300	955	15,000
Electric power in kw	50 to 73	110 to 120	150	736
Approximate ratio of kw. to kg	1-1	1-3	1-6	1-20

These figures are very instructive in showing in a general way how the electric power required per unit of output decreases with increasing capacity of the furnace.

From the foregoing it appears that pig iron can not be produced by electric smelting, along the lines heretofore tried, on a commercial scale to compete with blast furnace production, except under conditions of very cheap electric current and high-priced coke. The Canadian commission reported as their conclusion that, with electric energy at $10 per electric horsepower per year and coke at $7 per ton, the cost of production is approximately the same as the cost of producing pig iron in a modern blast furnace. But this is a cost figure for electric energy that has not been reached except under peculiarly favorable conditions. The utilization of the blast furnace gases in large gas engine plants for the generation of electric power will undoubtedly give comparatively cheap power for electrometallurgic work in the iron and steel industry.

For the production of the ferroalloys the electric furnace has decided advantages over the blast furnace, on account of the high temperature readily attainable. For the production of crucible and high-grade steels the work done in electric furnaces indicates that they will be more and more used and that the electric steel product will be an important feature of the industry in coming years.

BLAST FURNACES.

The statistics concerning the production of pig iron, presented herewith, show the industry according to kind of fuel used, and also by grade of product, as well as for the industry as a whole.

The term "pig iron," used in its broadest sense, includes all ferro products of the blast furnaces, whether run into pigs or used in a molten state in Bessemer converters or open-hearth furnaces. As a matter of fact more than one-third of the pig iron produced is used in a molten state. Pig iron is

[1] Electrochemical and Metallurgical Industry, May, 1907, page 173.

classified according to the kind of fuel used; bituminous pig iron being iron made with bituminous fuel—that is, with coke, or coke and bituminous coal mixed; anthracite pig iron being iron made with anthracite coal, alone or mixed with coke; and charcoal pig iron being iron made with charcoal as fuel. Some charcoal and coke pig iron, made with a mixed fuel of charcoal and coke, was reported in 1900, but none was reported in 1905. The statistics are first presented for the entire industry, and then for the two general groups: mineral fuel—including all pig iron made with bituminous coal, coke, or anthracite coal—and charcoal fuel.

The blast furnace product is also classified or graded according to the use for which it is adapted, or the character of the iron, namely, Bessemer, low-phosphorus, malleable Bessemer, basic, foundry, and forge; and also spiegeleisen, ferromanganese, ferrosilicon, etc.

The active blast furnace establishments were in operation on an average 9.12 months in 1905, compared with 10.16 months in 1900, 9.23 months in 1890, and 8 months in 1880.

The production of all kinds of pig iron in the United States for the census year 1905 amounted to 16,628,294 tons, of a reported value of $228,977,535, compared with 14,452,234 tons, valued at $206,579,400, in 1900. The increase in tonnage was 2,176,060 tons, or 15.1 per cent.

Table 17 shows the growth of the blast furnace industry from 1870 to 1905, by census periods.

TABLE 17.—BLAST FURNACES—COMPARATIVE SUMMARY, WITH PER CENT OF INCREASE: 1870 TO 1905.

	CENSUS.					PER CENT OF INCREASE.			
	1905 [1]	1900 [1]	1890	1880	1870 [2]	1900 to 1905	1890 to 1900	1880 to 1890	1870 to 1880
Number of establishments	191	224	304	341	380	[3] 14.7	[3] 26.3	[3] 10.8	[3] 11.7
Capital	[4] $239,559,194	[4] $148,226,113	[4] $134,608,543	$89,531,362	$56,145,326	61.6	10.1	50.3	59.5
Salaried officials, clerks, etc., number	2,236	1,763	[5] 1,068	(6)	(6)	26.8	65.1	....	....
Salaries	$2,897,917	$2,308,420	[5] $1,611,687	(6)	(6)	25.5	43.2	....	....
Wage-earners, average number	35,178	39,358	33,415	41,695	27,554	[3] 10.6	17.8	[3] 19.9	51.3
Total wages	$18,947,913	$18,500,462	$14,614,458	$12,655,428	$12,475,250	2.4	26.6	15.5	1.5
Men 16 years and over	35,093	39,261	33,341	40,503	26,962	[3] 10.6	17.8	[3] 17.7	50.2
Wages	$18,929,782	$18,480,649	$14,600,658	(6)	(6)	2.4	26.6	....	....
Women 16 years and over	4	6	(7)	9	54	[3] 33.3	....	....	[3] 83.3
Wages	$954	$1,352	(7)	(6)	(6)	[3] 29.4	....	....	....
Children under 16 years	81	91	74	1,183	538	[3] 11.0	23.0	[3] 93.7	119.9
Wages	$17,177	$18,461	$13,800	(6)	(6)	[3] 7.0	33.8	....	....
Miscellaneous expenses	$9,791,139	$7,463,234	$6,342,675	(7)	(7)	31.2	17.7	....	....
Cost of materials used	$178,967,449	$131,536,424	$110,098,615	$58,619,742	$45,498,017	36.1	19.5	87.8	28.8
Value of products [8]	$231,889,126	$206,823,202	$145,643,153	$89,315,569	$69,640,498	12.1	42.0	63.1	28.3
Tons of pig iron	16,628,294	14,452,234	8,845,185	3,375,912	1,832,876	15.1	63.4	162.0	84.2

[1] Includes 1 penal institution, the statistics for which are not included in the detailed summary.
[2] Includes idle establishments, which were not reported separately in 1870.
[3] Decrease.
[4] Includes value of rented property—1905, $3,158,283; 1900, $4,896,881; 1890, $5,061,058.
[5] Includes proprietors and firm members with their salaries; number only reported in 1900 and 1905, but not included in this table.
[6] Not reported separately.
[7] Not reported.
[8] Includes value of miscellaneous products for which tonnage was not reported.

A decrease in the number of establishments shown at each census will be noted, together with an increase in capital, operating expenses, and products. In 1905, as compared with 1900, there was a decrease of 33 active establishments, with an increase of $91,333,081 in reported capital. Accompanying the increase in production from 1900 to 1905 there is a decrease of 4,180 in the average number of wage-earners employed, there being 35,178 wage-earners reported in 1905, as compared with 39,358 in 1900. In 1890 the pig iron product showed an average for the year of 265 tons per wage-earner; while in 1900, through the use of larger furnaces, improvements in labor saving devices, etc., the pig iron product per wage-earner had risen to 367 tons. This gain in industrial economy continues, the last census showing an average pig iron product for the year of 473 tons per wage-earner, an increase of 28.9 per cent over 1900. As the number of wage-earners reported for 1880, as well as the amount of wages paid. includes a large number of employees engaged in mining and other operations, no comparisons can be made with that year.

The improvements in equipments and methods has resulted in the steady lowering of the labor item in the cost of production, as shown by the following tabular statement:

Relation of capital and specified items of expense to products.

	1905	1900	1890
Capital, per ton of product	$14.41	$10.26	$15.22
Expense, per ton of product	12.66	11.06	15.00
Salaries	0.17	0.16	0.18
Wages	1.14	1.28	1.65
Miscellaneous expenses	0.59	0.52	0.72
Cost of materials used	10.76	9.10	12.45
Value of all products, per ton of pig iron product	13.95	14.31	16.47

Materials cost $47,431,025 more in 1905 than in 1900, and the average cost of materials per ton of product shows an advance of $1.66 per ton of pig iron over that in 1900, although it is $1.69 per ton of product less than it was in 1890. Miscellaneous expenses, in like manner, show an advance of $2,327,905, and an increase of 7 cents per ton of pig iron product over 1900, but a decline of 13 cents per ton from 1890. The labor cost per ton of pig iron was reduced from $1.65 per ton in 1890 to $1.28 in 1900, a decrease of 22.4 per cent, and a further drop to $1.14 per ton in 1905, or 10.9 per cent.

The reduction in the number of wage-earners employed in the blast furnace industry has been chiefly due to the use of pig casting machines in place of sand casting, and to improvements in charging devices and in ore handling machines for stocking and charging.

The value of the products at the census of 1905 exceeded that in 1900 by $25,065,924, although the average value per ton of pig iron shows a decline of 36 cents. As these values of products include some by-products, they are not to be taken for net pig iron values, which will be considered later.

Table 18 is a comparative summary, by states, of the leading statistics of the pig iron industry for the censuses from 1880 to 1905, inclusive.

In 1905 there were blast furnaces in 23 states, but the furnaces in 3 of these states—North Carolina, Oregon, and Washington—were idle. In 1900 there were blast furnaces in 23 states (in the same states as in 1905), those in 2 states—Washington and Oregon—being idle. In 1890, 24 states produced pig iron, and 1 state—Minnesota—had an idle furnace, and in 1880 there were 22 producing states and 2 states and 1 territory—Minnesota, North Carolina, and Utah—in which the furnaces were idle. Pennsylvania is still far in advance of the other states as a producer of pig iron; Ohio, Illinois, and Alabama follow, as at the last census, in the order named. New York, which ranked seventh in 1900, has advanced to fifth place.

All of the states for which individual figures are given in the foregoing table, except Tennessee and Virginia, show an increase in the value of products from 1900 to 1905; and of the states included under "all other states," Colorado, Connecticut, Maryland, and Massachusetts reported increases in pig iron production. No pig iron product was reported from North Carolina at this census.

The decrease in Tennessee amounted to $1,265,166, or 27 per cent, and in Virginia to $3,161,791, or 48.6 per cent of the output of 1900. There were 13 idle blast furnace establishments reported in Virginia for 1905, and 7 in 1900. Of the 3 states for which detailed statistics were given in 1900 but not in 1905—Maryland, Texas, and West Virginia—Maryland and West Virginia report substantial increases and Texas a relatively large decrease. The decrease in the latter state was due to the fact that 2 blast furnaces which were active in 1900 were idle in 1905. The Texas product for 1905 was solely that of a furnace owned and operated by the state.

As before noted, the wage-earners employed in the manufacture of pig iron were less in number in 1905 than in 1900, although they received a larger average wage and turned out a much larger product.

In the early years practically all pig iron was sand cast, requiring a large amount of labor for handling the same. Now, however, more than one-third is delivered in a molten state to the mixers, converters and furnaces of steel plants, and one-fourth is machine cast.

Less than 40 per cent is represented by sand, chill, or direct castings. These changes in practice account in part for the decrease in blast furnace labor. In addition, the improvements in mechanical charging and in conveniences and methods for handling the slag have reduced the number of men required for a furnace crew.

The following states show fewer wage-earners in 1905 than in 1900, with an increase in the value of products: Alabama, Illinois, Ohio, Pennsylvania, and Wisconsin. The state of Illinois is most marked in this particular, the wage-earners and wages paid showing a decrease of 36.5 and 35.8 per cent, respectively, while the value of products show a large increase. As the quantity rather than the value of products manufactured is the best gauge of progress, a tabular statement is presented herewith showing the number of tons of pig iron produced per wage-earner and the average wage per ton of pig iron produced, for 1890, 1900, and 1905.

	Pig iron, tons per wage-earner.			Average wage per ton of pig iron.		
	1905	1900	1890	1905	1900	1890
United States	473	367	265	$1.14	$1.28	$1.65

This shows an increase in the number of tons of pig iron product per wage-earner of 38.5 per cent from 1890 to 1900, and of 28.9 per cent from 1900 to 1905; while the labor cost per ton of pig iron decreased 22.4 per cent from 1890 to 1900 and 10.9 per cent from 1900 to 1905.

The reduction in the labor factor through the improvements in equipment, as might be expected, is balanced by a coordinate increase in the capital invested. The investment in buildings, machinery, tools, and implements in 1905 in active establishments averaged $8.24 per ton of pig iron produced, as compared with $5.48 per ton in 1900, an increase of 50.4 per cent; and in the 5 leading states noted in the above statement this same item shows a corresponding increase.

TABLE 18.—BLAST FURNACES—COMPARATIVE SUMMARY, BY STATES: 1880 TO 1905.

STATE.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
				Number.	Salaries.	Average number.	Wages.			
United States	1905	191	[1]$239,559,194	2,236	$2,897,917	35,178	$18,947,913	$9,791,139	$178,967,449	$231,889,126
	1900	224	[1]148,226,113	1,763	2,308,420	39,358	18,500,462	7,463,234	131,536,424	206,823,202
	1890	304	[1]134,608,543	[2]1,068	[2]1,611,687	33,415	14,614,458	6,342,675	110,098,615	145,643,153
	1880	341	89,531,362	(3)	(3)	41,695	12,655,428	(4)	58,619,742	89,315,569
Alabama	1905	19	19,325,778	262	320,643	4,954	1,939,208	445,152	11,012,233	16,645,793
	1900	19	11,690,184	148	237,313	5,034	1,382,017	788,389	7,610,270	13,487,769
	1890	25	15,778,786	150	262,396	3,989	1,521,304	932,227	6,493,884	10,315,691
	1880	7	2,707,196	....	....	1,566	553,713	....	575,673	1,405,356
Connecticut[5]	1890	5	940,092	12	16,247	117	50,634	39,496	412,743	574,438
	1880	6	1,172,000	....	....	139	65,974	....	471,467	644,911
Georgia	1905	4	1,158,151	41	44,838	303	112,698	37,536	720,836	943,204
	1900	3	666,916	18	13,295	194	48,391	8,300	237,421	391,599
	1890	4	748,845	15	19,175	254	45,501	52,770	237,836	339,422
	1880	5	712,000	....	....	754	77,415	....	241,796	466,890
Illinois	1905	4	14,263,055	83	100,661	1,910	1,397,969	958,945	19,005,423	27,330,836
	1900	4	10,683,913	210	294,524	3,010	2,176,274	691,724	11,707,965	15,153,646
	1890	5	9,855,274	11	23,115	1,420	896,030	215,252	8,088,153	10,138,310
	1880	3	950,000	....	....	498	185,054	....	1,762,609	2,391,850
Kentucky[5]	1890	4	826,199	16	17,038	262	88,482	49,655	461,608	665,763
	1880	9	2,098,035	....	....	1,890	429,988	....	801,410	1,248,652
Maryland[6]	1900	3	1,388,000	14	17,148	659	302,068	147,634	2,562,412	3,072,746
	1890	5	3,108,222	[illegible]	7,530	630	143,812	23,830	1,316,539	1,632,004
	1880	12	2,197,125	....	....	1,443	339,978	....	956,806	1,700,339
Michigan	1905	11	4,383,106	97	109,596	1,139	587,724	203,657	3,104,136	4,643,538
	1900	7	2,029,713	44	64,451	513	216,030	131,047	1,404,924	2,327,153
	1890	15	5,259,001	57	95,312	675	321,022	271,067	2,935,233	3,982,278
	1880	13	2,671,386	....	....	2,164	561,870	....	2,091,224	3,145,062
Missouri[5]	1890	5	1,883,470	27	37,763	627	261,203	73,138	1,247,688	1,716,983
	1880	4	2,450,000	....	....	1,185	227,111	....	1,685,124	2,275,017
New Jersey	1905	5	5,414,051	32	43,715	774	370,751	191,355	2,940,780	3,601,511
	1900	9	2,474,639	50	44,888	589	292,213	90,619	1,987,594	2,546,215
	1890	8	3,131,366	15	22,386	640	240,152	129,384	1,679,937	2,228,724
	1880	12	3,644,500	....	....	1,174	365,639	....	2,488,670	3,428,747
New York	1905	9	15,188,910	76	157,145	1,559	1,161,179	308,332	6,373,563	8,634,737
	1900	9	4,003,641	45	81,221	1,033	632,393	288,587	3,508,100	5,046,145
	1890	16	6,443,208	52	91,181	1,410	581,107	349,788	4,212,888	5,182,606
	1880	30	8,836,471	....	....	2,518	902,929	....	4,166,622	6,816,241
Ohio	1905	33	43,856,382	395	568,258	5,434	3,471,083	1,812,570	32,476,727	40,862,451
	1900	43	23,296,130	286	342,271	6,039	3,286,644	1,266,259	23,543,473	40,366,637
	1890	46	11,750,497	167	200,890	4,057	1,856,237	740,283	15,696,665	19,800,268
	1880	62	13,002,586	....	....	8,944	2,725,157	....	9,149,620	13,038,193
Pennsylvania	1905	65	109,314,103	891	1,113,956	13,867	7,763,931	4,579,941	86,321,875	107,455,267
	1900	77	74,850,426	609	786,852	16,075	8,038,016	3,269,022	64,095,277	101,575,487
	1890	116	59,321,570	355	561,407	15,612	7,084,308	2,684,671	57,222,481	75,239,203
	1880	137	41,488,294	....	....	13,460	4,752,838	....	29,675,075	45,573,750
Tennessee	1905	13	5,939,783	128	127,831	1,358	545,861	205,303	2,609,157	3,428,049
	1900	13	5,303,095	81	103,258	1,763	438,929	214,207	3,168,581	4,693,215
	1890	11	3,685,806	64	87,616	1,012	438,376	185,574	2,450,882	3,366,464
	1880	9	1,422,626	....	....	1,579	261,897	....	489,440	840,022
Texas[7]	1900	3	379,215	14	9,160	248	42,661	8,229	90,439	172,468
	1880	1	40,000	....	....	140	27,720	....	23,580	36,000
Virginia	1905	10	3,157,268	69	81,865	1,081	346,471	175,308	2,717,051	3,343,427
	1900	16	5,027,752	116	146,764	1,594	528,567	160,399	4,374,316	6,505,218
	1890	15	4,156,206	60	80,207	1,268	478,105	273,278	2,820,167	3,925,481
	1880	8	1,391,500	....	....	1,221	255,986	....	205,548	440,695
West Virginia[6]	1900	3	1,080,553	24	21,051	492	227,235	58,787	1,693,042	3,119,301
	1890	4	1,446,082	13	16,758	411	182,175	59,143	1,503,847	2,009,505
	1880	8	1,322,425	....	....	893	240,158	....	1,158,611	1,631,096
Wisconsin	1905	4	2,649,011	39	62,859	482	257,024	160,576	2,250,807	3,074,712
	1900	5	1,891,765	26	41,825	551	307,733	109,478	2,015,134	2,900,237
	1890	8	3,546,340	16	30,154	595	276,887	175,405	2,378,006	3,114,892
	1880	7	2,068,218	....	....	853	357,354	....	2,101,393	3,295,835
All other states	[8]1905	14	14,909,596	123	166,550	2,317	994,014	712,464	9,434,861	11,925,601
	[9]1900	10	3,460,171	78	104,399	1,564	581,291	230,553	3,537,476	5,465,366
	[10]1890	9	2,727,579	39	42,512	436	149,123	87,714	940,058	1,411,121
	[11]1880	8	1,357,000	....	....	1,274	324,647	....	575,074	936,913

[1] Includes value of rented property—1905, $3,158,283; 1900, $4,896,881; 1890, $5,061,058.
[2] Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905, but not included in this table.
[3] Not reported separately.
[4] Not reported.
[5] Included in "all other states" in 1900 and 1905.
[6] Included in "all other states" in 1905.
[7] Included in "all other states" in 1890 and 1905.
[8] Includes establishments distributed as follows: Colorado, 1; Connecticut, 2; Kentucky, 1; Maryland, 2; Massachusetts, 1; Minnesota, 1; Missouri, 2; Texas, 1; West Virginia, 3.
[9] Includes establishments distributed as follows: Colorado, 1; Connecticut, 1; Kentucky, 2; Massachusetts, 1; Minnesota, 1; Missouri, 2; North Carolina, 2.
[10] Includes establishments distributed as follows: Colorado, 1; Indiana, 2; Maine, 1; Massachusetts, 1; North Carolina, 1; Oregon, 1; Texas, 1; Washington, 1.
[11] Includes establishments distributed as follows: Indiana, 3; Maine, 1; Massachusetts, 2; Oregon, 1; Vermont, 1.

CAPITAL.

Table 19 shows the number of active and idle blast furnace establishments in the United States in 1880, 1890, 1900, and 1905, and the capital invested.

TABLE 19.—*Blast furnaces—active and idle establishments—capital: 1880 to 1905.*

	Census.	Number of establishments.	CAPITAL. Total.	Buildings, machinery, tools, and implements.	Land, cash, and sundries.
Total	1905	265	[1] $262,395,742	$153,591,699	$108,804,043
	1900	273	[1] 158,352,558	86,103,804	72,248,754
	1890	377	[1] 141,067,408	75,931,198	65,136,210
	1880	483	103,926,245	47,545,631	56,380,614
Active	1905	191	239,559,194	136,960,688	102,598,506
	1900	224	148,226,113	79,235,189	68,990,924
	1890	304	134,608,543	71,236,048	63,372,495
	1880	341	89,531,362	41,268,481	48,262,881
Idle	1905	74	22,836,548	16,631,011	6,205,537
	1900	49	10,126,445	6,868,615	3,257,830
	1890	73	6,458,865	4,695,150	1,763,715
	1880	142	14,394,883	6,277,150	8,117,733

[1] Includes value of rented property—1905, $4,165,283; 1900, $5,087,881; 1890, $5,061,058.

The decrease in the number of all establishments in 1905 from that in 1900 was 8, and from that in 1890, 112. At the census of 1905 there were 74 idle establishments, a relatively larger number than at any census since 1880, but the idle plants were, as a rule, minor ones, as shown by the fact that though they constituted 27.9 per cent of all establishments, the capital invested in them formed only 8.7 per cent of the total.

The increase in capital is very large, being $104,043,184 in 1905, or 65.7 per cent, as compared with 1900; whereas for the decade 1890 to 1900 the increase was $17,285,150, or 12.3 per cent, and for the period 1880 to 1890 the increase was $37,141,163, or 35.7 per cent.

MATERIALS USED.

Table 20 shows in detail the quantities and cost of materials consumed by blast furnaces for each census year beginning with 1880. In 1900 and 1905 the cost of the materials as reported separately by items does not in all cases include freight. Freight not included in the cost of materials, as reported by items, is included under "all other materials." In 1880 and 1890 the cost reported for each material was the total cost at the point of consumption.

TABLE 20.—BLAST FURNACES—MATERIALS USED, BY KIND, QUANTITY, AND COST, WITH PER CENT OF INCREASE: 1880 TO 1905.

KIND.	CENSUS. 1905 Tons.	1905 Cost.	1900 Tons.	1900 Cost.	1890 Tons.	1890 Cost.	1880 Tons.	1880 Cost.	PER CENT OF INCREASE. 1900 to 1905 Tons.	1900 to 1905 Cost.	1890 to 1900 Tons.	1890 to 1900 Cost.	1880 to 1890 Tons.	1880 to 1890 Cost.
Total	....	$178,967,449	....	$131,536,424	....	$110,098,615	....	$58,619,742	......	36.1	......	19.5	......	87.8
Domestic iron ore	29,212,267	96,210,908	24,621,397	61,800,805	14,048,571	57,607,945	6,479,182	33,205,278	18.6	55.7	75.3	7.3	116.8	73.5
Foreign iron ore, including manganese ore	829,918	4,739,123	754,383	4,107,449	973,850	5,897,585	(1)	(1)	10.0	15.4	[2] 22.5	[2] 20.4	......	......
Fluxing materials	8,327,221	6,892,671	7,326,706	5,059,632	5,021,688	4,196,878	2,829,598	2,547,336	13.7	36.2	45.9	20.6	77.5	64.8
Anthracite coal and culm	560,637	1,812,779	886,564	2,297,419	1,796,854	5,165,761	2,334,984	8,012,755	[2] 36.8	[2] 21.1	[2] 50.7	[2] 55.5	[2] 23.0	[2] 35.5
Bituminous coal and slack	801,640	1,340,997	832,235	1,101,312	491,971	759,522	939,065	2,095,887	[2] 3.7	21.8	69.2	45.0	[2] 47.6	[2] 63.8
Coke	[3] 19,739,676	57,127,027	[3] 16,461,533	38,976,770	[3] 9,237,935	27,435,780	[3] 2,128,255	8,129,240	19.9	46.6	78.2	42.1	334.1	237.5
Charcoal	[4] 37,796,739	2,538,452	[4] 31,421,585	1,846,201	[4] 67,672,156	4,523,320	[4] 53,909,828	3,679,120	20.3	37.5	[2] 53.6	[2] 59.2	25.5	22.9
Mill cinder and scrap, etc	1,865,385	3,830,961	1,600,313	3,772,385	1,145,599	3,086,808	316,114	910,667	16.6	1.6	39.7	22.2	262.4	239.0
All other materials	....	4,474,531	....	12,574,451	....	1,425,016	....	39,459	......	[2] 64.4	......	782.4	......	3,511.4

[1] Domestic and foreign ore were not reported separately in 1880. [2] Decrease. [3] Short tons. [4] Bushels.

One-half of the foreign ore consumed was used by Maryland furnaces, 46 per cent by furnaces in Pennsylvania, and the remainder by Illinois, New Jersey, Virginia, and Kentucky furnaces. Small amounts only were reported for the last 2 states.

In addition to iron ore there was consumed 1,865,385 tons of mill cinder, scrap, scale, etc., not including runner or other scrap produced by the furnaces reporting. There was thus a total of 31,907,570 tons of constituent material, an increase of 4,931,477 tons over the amount reported for 1900, or 18.3 per cent. From this material there was made in 1905, 16,628,294 tons of pig iron, compared with 14,452,234 tons of pig iron made from 26,976,093 tons of like material in 1900; 8,845,185 tons of pig iron, from 16,168,020 tons of material in 1890; and 3,375,912 tons of pig iron, from 6,795,296 tons of all material in 1880. The percentages of pig iron extraction from iron making material were—in 1905, 52.1 per cent; in 1900, 53.6 per cent; in 1890, 54.7 per cent; and in 1880, 49.7 per cent.

In 1890 Mr. John Birkinbine, special agent in charge of the collection of iron ore statistics for the Eleventh Census, estimated the yield of metal in the blast furnace from foreign iron ore, mill cinder, rolling mill scale, zinc residuum, etc., at about 57 per cent, and the same factor was used by Mr. William G. Gray,

expert special agent for the Twelfth Census, in computing the product derived from all material other than domestic iron ore. Following the same line of deduction, the metal yield from foreign iron ore, and mill cinder, scrap, scale, etc., is estimated for 1905 as 1,536,323 tons, and when this is deducted from the total pig iron product, 15,091,971 tons of pig iron remain as the product from domestic iron ores, or an average yield of metal from domestic iron ore of 51.7 per cent, compared with 53.2 per cent for 1900, 54.4 per cent for 1890, and approximately 48.9 per cent for 1880.

As explained in the report of the Twelfth Census on pig iron production, no statistics of the consumption of foreign iron ore by blast furnaces in 1880 being available, the consumption was estimated from the imports.

PRODUCTS.

The production of pig iron according to the kind of fuel used, and the percentage of total production by fuels for each census year since and including 1880 are shown in Table 21. The production of spiegeleisen, ferromanganese, and direct castings is included.

TABLE 21.—BLAST FURNACES—PRODUCTION OF PIG IRON, INCLUDING DIRECT CASTINGS, CLASSIFIED ACCORDING TO KIND OF FUEL USED, WITH PER CENT OF TOTAL: 1880 TO 1905.

	QUANTITY (TONS).				PER CENT OF TOTAL.			
	1905	1900	1890	1880[1]	1905	1900	1890	1880
Total	16,628,294	14,452,234	8,845,185	3,375,912	100.0	100.0	100.0	100.0
Mixed anthracite coal and coke pig iron	1,274,721	1,796,000	1,690,394	638,027	7.7	12.4	19.1	18.9
Coke and bituminous coal pig iron	14,909,029	12,253,818	6,265,865	1,354,958	89.6	84.8	70.8	40.1
Charcoal pig iron	414,171	303,567	593,492	388,677	2.5	2.1	6.7	11.5
Anthracite coal pig iron	30,373	45,857	295,434	994,250	0.2	0.3	3.4	29.5
Mixed charcoal and coke pig iron		52,992				0.4		

[1] The 4,229 tons of direct castings shown in the report for blast furnaces, 1880, have been distributed among the several kinds of pig iron; hence the quantities of pig iron do not agree with the data shown in the report for the Tenth Census.

The production of pig iron with mixed anthracite coal and coke for fuel is less than it was in 1900 by 521,279 tons, and the quantity in 1900, though slightly greater in amount than the 1890 product, was proportionately less than that of 1890 and 1880. The great increase continues to be in bituminous fuel pig iron; that is, in pig iron made with coke alone or with mixed coke and bituminous coal, a mixed fuel of coke and bituminous coal being used to some extent in Ohio and Kentucky.

The increase in coke and bituminous coal pig iron, chiefly coke, for the five-year period since the 1900 census was 2,655,211 tons, or 21.7 per cent; and for the decade from 1890 to 1900 it was 5,987,953 tons, or 95.6 per cent.

Charcoal pig iron shows an increase of 110,604 tons, or 36.4 per cent, over 1900, and it constitutes a slightly larger per cent of the entire product than it did in 1900. The larger part of the increase was in Michigan. In 1900 there was a heavy drop in the production of charcoal pig iron.

Pig iron made with anthracite coal continues to show a heavy decline, and the use of such coal in the production of pig iron is gradually being abandoned. No pig iron made with mixed charcoal and coke fuel was reported at this census.

Table 22 shows in detail the quantity and value of the pig iron made in the United States in 1880, 1890, 1900, and 1905, according to the kind of fuel used, the pig iron product including spiegeleisen, ferromanganese, and direct castings.

TABLE 22.—BLAST FURNACES—QUANTITY AND VALUE OF PRODUCTS, CLASSIFIED ACCORDING TO KIND OF FUEL USED, WITH PER CENT OF INCREASE: 1880 TO 1905.

KIND.	CENSUS.								PER CENT OF INCREASE.					
	1905		1900		1890		1880[1]		1900 to 1905		1890 to 1900		1880 to 1890	
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
Aggregate		$231,889,126		$206,823,202		$145,643,153		$89,315,569		12.1		42.0		63.1
Total pig iron	16,628,294	228,977,535	14,452,234	206,579,400	8,845,185	145,612,983	3,375,912	88,204,010	15.1	10.8	63.4	41.9	162.0	65.1
Mixed anthracite coal and coke pig iron	1,274,721	17,712,934	1,796,000	26,066,003	1,690,394	28,195,996	638,027	16,627,291	[2]29.0	[2]32.0	6.2	[2]7.6	164.9	69.6
Coke and bituminous coal pig iron	14,909,029	203,814,049	12,253,818	173,763,091	6,265,865	100,687,256	1,354,958	35,513,233	21.7	17.3	95.6	72.6	362.4	183.5
Charcoal pig iron	414,171	7,059,504	303,567	5,338,739	593,492	11,957,710	388,677	12,488,744	36.4	32.2	[2]48.9	[2]55.4	52.7	[2]4.3
Anthracite coal pig iron	30,373	391,048	45,857	612,702	295,434	4,772,021	994,250	23,574,742	[2]33.8	[2]36.2	[2]84.5	[2]87.2	[2]70.3	[2]79.8
Mixed charcoal and coke pig iron			52,992	798,865										
All other products		2,911,591		243,802		30,170		1,111,559		1,094.2		708.1		[2]97.3

[1] The 4,229 tons of direct castings shown in the report for blast furnaces, 1880, have been distributed among the several kinds of pig iron; hence the quantities of pig iron do not agree with the data shown in the report for the Tenth Census.
[2] Decrease.

The spiegeleisen product for the census year amounted to 169,630 tons (see Table 24), and the ferromanganese, to 58,018 tons (the latter including a small amount of ferrophosphorus)—a total of 227,648 tons, valued at $6,084,247, or an average of $26.73 per ton. In 1900 the spiegeleisen product was 163,672 tons and the ferromanganese 51,878 tons, giving a total of 215,550 tons, which was valued at $5,871,955, or an average value per ton of $27.24. This shows for the five-year period an increase in the spiegeleisen product of 3.6 per cent, in ferromanganese 11.8 per cent, and in the combined product an increase of 5.6 per cent in quantity and of 3.6 per cent in value. Of the spiegeleisen and ferromanganese product, 44,203 tons, of a value of $881,307, were made with mixed anthracite coal and coke fuel, and 183,445 tons, of a value of $5,202,940, with coke or coke and bituminous fuel. Spiegeleisen was made in Colorado, Illinois, New Jersey, and Pennsylvania, and ferromanganese, in Pennsylvania. The ferrophosphorus product was from Tennessee.

Direct castings were produced by establishments located in Alabama, Georgia, Illinois, New York, Ohio, Pennsylvania, and Tennessee, to the amount of 9,469 tons, valued at $131,700, an average of $13.91 per ton. This is an increase of 32.9 per cent in quantity and 50.2 per cent in value over 1900. Pig iron used for direct castings was all made with coke or coke and bituminous coal for fuel.

Products other than pig iron amounted to $2,911,591. Of this amount, $338,941 was reported under the heading of "amount received for custom work and repairing," and $2,572,650 for miscellaneous products under the general heading "all other products, including castings made in foundries, granulated slag, cement from furnace slag, slag sold for ballast, etc." In 1900 the value of these miscellaneous products was $99,940. The increase was due to a large extent to the utilization of furnace slag in the manufacture of cement.

Table 23 shows the pig iron product by tonnage, value, and average value per ton, for 1880, 1890, 1900, and 1905, and the total number of completed furnaces for all establishments, whether active or idle, for the same years, by states. Direct castings, spiegeleisen, ferromanganese, and ferrosilicon are included, but not the value of miscellaneous products or the amount received for custom work and repairing.

As in 1900, the highest average values per ton for pig iron are reported for Massachusetts and Connecticut, but details can not be given, as there was but 1 establishment producing pig iron in the former state and 2 in the latter. The product of both states was charcoal pig iron. Colorado comes next, followed by Michigan, which latter state has an average value per ton of $17.09. Nine-tenths of the pig iron product of Michigan was charcoal pig iron.

TABLE 23.—*Blast furnaces—quantity and value of all kinds of pig iron, with average value per ton, by states: 1880 to 1905.*

STATE.	Census.	Number of completed furnaces.	Tons.	Value.	Average value per ton.
United States	1905	435	16,628,294	$228,977,535	$13.77
	1900	399	14,452,234	206,579,400	14.29
	1890	559	8,845,185	145,612,983	16.46
	1880	681	3,375,912	88,204,010	26.13
Alabama	1905	49	1,471,378	16,614,577	11.29
	1900	45	1,203,277	13,487,769	11.21
	1890	48	817,508	10,315,691	12.62
	1880	15	55,657	1,402,156	25.19
Connecticut [1]	1890	9	19,871	574,438	28.91
	1880	8	16,767	644,911	38.46
Georgia	1905	4	74,504	904,950	12.15
	1900	5	21,505	386,271	17.96
	1890	5	25,099	339,422	13.52
	1880	10	20,624	457,490	22.18
Illinois	1905	21	1,660,610	25,508,271	15.36
	1900	17	1,469,530	15,033,696	10.23
	1890	15	666,676	10,136,960	15.21
	1880	10	85,239	2,391,850	28.06
Kentucky [1]	1890	6	39,534	665,763	16.84
	1880	22	51,882	1,240,152	23.90
Maryland [2]	1900	7	241,172	3,060,870	12.69
	1890	14	86,282	1,632,004	18.91
	1880	22	53,271	1,668,164	31.31
Michigan	1905	11	270,933	4,630,183	17.09
	1900	13	141,377	2,327,153	16.46
	1890	26	203,417	3,982,278	19.58
	1880	27	106,774	3,123,245	29.25
Missouri [1]	1890	8	90,205	1,716,983	19.03
	1880	17	84,866	2,196,780	25.89
New Jersey	1905	13	262,308	3,600,144	13.72
	1900	11	150,002	2,521,066	16.81
	1890	18	129,500	2,228,724	17.21
	1880	20	140,548	3,410,663	24.27
New York	1905	22	609,588	8,411,946	13.80
	1900	19	334,512	5,042,550	15.07
	1890	37	307,446	5,182,606	16.86
	1880	57	279,793	6,697,349	23.94
Ohio	1905	65	2,987,787	40,705,777	13.62
	1900	53	2,559,694	40,308,758	15.75
	1890	71	1,203,142	19,800,203	16.46
	1880	103	489,921	12,908,286	26.35
Pennsylvania	1905	157	7,729,278	107,395,757	13.89
	1900	148	6,778,584	101,555,787	14.98
	1890	221	4,345,986	75,212,758	17.31
	1880	269	1,723,492	44,940,028	26.08
Tennessee	1905	22	303,624	3,426,932	11.29
	1900	19	374,249	4,693,215	12.54
	1890	19	264,187	3,366,464	12.74
	1880	21	42,744	824,932	19.30
Texas [3]	1900	4	9,789	172,468	17.62
	1880	1	1,250	36,000	28.80
Virginia	1905	26	279,103	3,333,273	11.94
	1900	26	428,117	6,505,218	15.19
	1890	31	278,899	3,925,481	14.07
	1880	31	15,988	429,695	26.88
West Virginia [1]	1890	5	115,508	2,009,505	17.10
	1880	11	71,473	1,624,296	22.73
Wisconsin	1905	6	189,141	2,761,107	14.60
	1900	6	217,451	2,899,912	13.34
	1890	10	192,092	3,114,892	16.22
	1880	14	105,609	3,293,635	31.19
All other states	[4] 1905	39	790,040	11,684,618	14.79
	[5] 1900	26	522,975	8,584,667	16.42
	[6] 1890	16	59,833	1,408,811	23.55
	[7] 1880	23	30,014	914,378	30.46

[1] Included in "all other states" in 1900 and 1905.
[2] Included in "all other states" in 1905.
[3] Included in "all other states" in 1890 and 1905.
[4] Includes states as follows: Colorado, Connecticut, Kentucky, Maryland, Massachusetts, Minnesota, Missouri, Texas, West Virginia.
[5] Includes states as follows: Colorado, Connecticut, Kentucky, Massachusetts, Minnesota, Missouri, North Carolina, West Virginia.
[6] Includes states as follows: Colorado, Indiana, Maine, Massachusetts, North Carolina, Oregon, Texas, Washington.
[7] Includes states as follows: Indiana, Maine, Massachusetts, Oregon, Vermont.

In 1900 the highest value reported for pig iron that could be given in detail was for Georgia, $17.96 per ton, and most of the product was made with charcoal fuel; but at this census the average value for that state is $12.15 per ton, and nearly 60 per cent of the product of the state is made with mineral fuel. Alabama and Tennessee show the lowest average value per ton, $11.29, this being a slight advance for Alabama over the average reported in 1900, which was $11.21, and a decline for Tennessee of $1.25 per ton from the average of 1900. Pennsylvania shows an average value of $13.89 per ton, as against $14.98 for 1900; and Ohio, $13.62 per ton, as against $15.75 for 1900.

Illinois shows a large advance in the average value per ton since 1900, but the average for 1900 is so out of balance with the other states that the figures are open to question.

The average value for the country at large was $13.77 in 1905, $14.29 in 1900, $16.46 in 1890, and $26.13 in 1880. The states showing an average value in 1905 below the general average for the United States are New Jersey, West Virginia, Ohio, Minnesota, Georgia, Virginia, Tennessee, and Alabama; and the states ranging above the general average are New York, Missouri, Pennsylvania, Maryland, Texas, Wisconsin, Illinois, Colorado, Kentucky, Michigan, Connecticut, and Massachusetts.

Table 24 shows the production of pig iron by grades and by states for 1900 and 1905. Statistics by grades were not taken prior to 1900. Low-phosphorus pig iron is below 0.04 per cent in phosphorus and Bessemer pig iron contains from 0.04 to 0.10 per cent. In 1900 both grades were included under Bessemer.

Statistics relating to malleable Bessemer pig iron were not reported separately in 1900. At that census the producers of malleable Bessemer in some cases reported it in the Bessemer class, in other cases as foundry, and in other cases in the class of white and mottled and miscellaneous grades.

Malleable Bessemer pig iron as a classified grade first appears in the reports of the American Iron and Steel Association for the calendar year 1900, the amount reported being 173,413 tons. An increase to 256,532 tons was shown in 1901 and to 311,458 tons in 1902. The rate of growth indicates that the production for the calendar year covered by the census of 1900 was something less than 125,000 tons. Malleable Bessemer, so called, is a Bessemer pig iron low in silicon, and is used for casting purposes.

TABLE 24.—BLAST FURNACES—QUANTITY OF PIG IRON, BY GRADES, WITH NUMBER OF ESTABLISHMENTS REPORTING, BY STATES: 1905 AND 1900.

STATE.	Census.	Total production (tons).	BESSEMER.		LOW-PHOSPHORUS.		MALLEABLE BESSEMER.		BASIC.		FOUNDRY.	
			Number of establishments reporting.	Tons.	Number of establishments reporting.	Tons.	Number of establishments reporting.	Tons.	Number of establishments reporting.	Tons.	Number of establishments reporting.	Tons.
United States	1905	16,628,294	65	8,894,584	10	192,795	25	316,964	32	2,553,940	128	3,679,243
	1900	14,452,234	86	8,475,530		(1)		(1)	27	937,439	154	3,514,743
Alabama	1905	1,471,378							3	300,784	18	1,026,969
	1900	1,203,277							2	89,746	19	883,208
Colorado	1905	119,874	1	112,318								
	1900	112,843	1	109,443								
Connecticut	1905	12,753									2	12,753
	1900	10,457									1	10,457
Georgia	1905	74,504									4	57,077
	1900	21,505									3	18,870
Illinois	1905	1,660,610	3	1,424,030			1	31,588	1	52,658	1	105,835
	1900	1,469,530	3	1,320,287							2	94,008
Kentucky	1905	32,432										
	1900	126,566	1	21,825					1	560	2	73,407
Maryland	1905	293,481	1	292,642							1	839
	1900	241,172	1	218,691							2	5,056
Massachusetts	1905	3,514									1	3,514
	1900	3,030									1	3,030
Michigan	1905	270,933	2	3,520			1	5,787			11	261,626
	1900	141,377									7	136,741
Minnesota	1905	20,769	1	2,070			1	18,699				
	1900	29,269	1	22,070					1	20	1	6,879
Missouri	1905	33,481							2	24,082	1	9,399
	1900	40,975							2	13,041	2	25,881
New Jersey	1905	262,308					1	984	2	112,635	4	102,339
	1900	150,002	[illegible]	25,575							4	61,840
New York	1905	609,588	3	225,414	1	26,851	2	34,848	1	4,669	4	275,104
	1900	334,512									9	291,993
North Carolina[2]	1900	11,543	1	1,846							1	7,789
Ohio	1905	2,987,787	23	2,120,643			12	127,330	4	206,458	18	441,227
	1900	2,559,694	28	1,862,136					4	93,700	20	305,004
Pennsylvania	1905	7,729,278	28	4,457,613	8	139,763	4	12,497	17	1,827,121	37	796,740
	1900	6,778,584	41	4,617,969					13	666,589	45	856,472
Tennessee	1905	303,624			1	26,181					12	247,368
	1900	374,249	1	11,648					1	802	13	287,655
Texas	1905	4,669									1	3,933
	1900	9,789									3	6,191
Virginia	1905	279,103							2	25,533	9	219,322
	1900	428,117							3	72,981	14	304,466
West Virginia	1905	269,067	2	219,023			1	50,044				
	1900	188,292	3	188,292								
Wisconsin	1905	189,141	1	37,311			2	35,187			4	115,198
	1900	217,451	3	75,748							5	135,796

[1] Not reported separately in 1900.

[2] No production in 1905.

TABLE 24.—BLAST FURNACES—QUANTITY OF PIG IRON, BY GRADES, WITH NUMBER OF ESTABLISHMENTS REPORTING, BY STATES: 1905 AND 1900—Continued.

STATE.	Census.	FORGE.		WHITE AND MOTTLED AND MISCELLANEOUS GRADES.		FERROSILICON.		SPIEGELEISEN.		FERROMANGANESE.		DIRECT CASTINGS.	
		Number of establishments reporting.	Tons.	Number of establishments reporting.	Tons.	Number of establishments reporting.	Tons.	Number of establishments reporting.	Tons.	Number of establishments reporting.	Tons.	Number of establishments reporting.	Tons.
United States	1905	55	601,956	55	99,084	3	52,611	[illegible]	169,630	4	58,018	18	9,469
	1900	102	1,057,616	99	208,323	7	35,910	11	163,672	3	51,878	24	7,123
Alabama	1905	15	115,455	16	27,838							1	332
	1900	15	171,298	14	56,561							7	2,464
Colorado	1905							1	7,556				
	1900							1	3,400				
Connecticut	1905												
	1900												
Georgia	1905	1	8,668	1	8,700							1	59
	1900	1	1,593	1	1,042								
Illinois	1905	1	1,411					1	44,408			1	680
	1900	1	7,500					1	47,688			1	47
Kentucky	1905					1	32,432						
	1900	1	20,218	2	3,856	1	6,700						
Maryland	1905												
	1900	1	1,400	1	400			1	15,625				
Massachusetts	1905												
	1900												
Michigan	1905												
	1900			1	4,636								
Minnesota	1905												
	1900			1	300								
Missouri	1905												
	1900	1	2,000	1	43							1	10
New Jersey	1905	3	32,831	3	2,277			1	11,242				
	1900	4	34,634	5	6,079			2	21,824			1	50
New York	1905	3	34,403	2	7,989							1	310
	1900	4	38,699	5	3,416					1	404		
North Carolina [1]	1900	1	1,439	1	469								
Ohio	1905	5	66,729	5	3,777	1	16,494					5	5,129
	1900	17	246,487	[illegible]	33,347	4	19,020						
Pennsylvania	1905	23	313,301	16	12,121	1	3,685	6	106,424	3	57,072	8	2,941
	1900	35	446,328	32	50,077	2	10,190	6	[2] 75,135	2	51,474	12	4,350
Tennessee	1905	7	24,957	6	4,154					1	[3] 946	1	18
	1900	8	54,182	9	19,962								
Texas	1905	1	279	1	457								
	1900	1	42	2	3,556								
Virginia	1905	3	3,922	4	30,326								
	1900	11	28,661	12	21,807							2	202
West Virginia	1905												
	1900												
Wisconsin	1905			1	1,445								
	1900	1	3,135	3	2,772								

[1] No production in 1905.

[2] Includes 355 tons of silico-spiegel.

[3] Ferrophosphorus.

The percentage which each grade formed of the total in 1900 and 1905 is shown by the following statement:

GRADE.	PER CENT OF TOTAL PIG IRON PRODUCTION.	
	1905	1900
Bessemer	53.5	58.6
Low-phosphorus	1.2	
Malleable Bessemer	1.9	......
Basic	15.4	6.5
Foundry	22.1	24.3
Forge	3.6	7.3
White and mottled, and miscellaneous grades	0.6	1.4
Ferrosilicon	0.3	0.2
Spiegeleisen	1.0	1.1
Ferromanganese	0.3	0.4
Direct castings	0.1	0.1

Bessemer and low-phosphorus combined constituted 54.7 per cent of the total pig iron production of 1905, as compared with 58.6 per cent of 1900, when low-phosphorus was reported under Bessemer. The combined product was 9,087,379 tons, an increase of 611,849 tons over 1900, or 7.2 per cent.

Basic pig iron shows the heavy increase of 172.4 per cent. Its proportion of the total pig iron product increased from 6.5 per cent in 1900 to 15.4 per cent in 1905.

Foundry, forge, and the white and mottled and miscellaneous grades form smaller proportions of the total production than in 1900; in quantity, foundry pig iron has increased but 164,500 tons, or 4.7 per cent, while the amount of forge pig iron is 455,660 tons less than in 1900, or a decrease of 43.1 per cent, and the white and mottled and miscellaneous grades show a decrease of 109,239 tons, or 52.4 per cent. Ferrosilicon shows an increase of 46.5 per cent; spiegeleisen, 3.6 per cent; ferromanganese, 11.8 per cent; and direct castings, 32.9 per cent.

Iron for steel making—comprising Bessemer, low-phosphorus, basic, ferrosilicon, spiegeleisen, and ferromanganese—aggregated 11,921,578 tons, an increase of 2,257,149 tons, or 23.4 per cent over the production of like grades in 1900; while iron for use in puddling furnaces, namely, forge, and white and mottled iron, aggregated 701,040 tons, a decrease of 44.6 per cent. In 1900 pig iron for steel making was a little over seven times that made for use in puddling furnaces, and now it is seventeen times in quantity.

Pennsylvania produced one-half of the Bessemer (50.1 per cent); nearly three-fourths of the low-phosphorus (72.5 per cent); nearly three-fourths of the basic (71.5 per cent); over one-fifth of the foundry (21.7 per cent); more than one-half of the forge (52 per cent); over three-fifths of the spiegeleisen (62.7 per cent); all of the ferromanganese; nearly one-third of the direct castings (31.1 per cent); and relatively small amounts of the remaining grades—namely, malleable Bessemer, 3.9 per cent; white and mottled, and miscellaneous grades, 12.2 per cent; and ferrosilicon, 7 per cent.

Ohio, which was second in total products, was second in the production of Bessemer pig iron (23.8 per cent) and first in malleable Bessemer (40.2 per cent) and in direct castings (54.2 per cent). In basic pig iron Ohio, keeping pace with the large general growth of this grade, has increased from 93,700 tons in 1900 to 206,458 in 1905, or 120.3 per cent, but is now exceeded in basic iron product by Alabama as well as Pennsylvania, and hence ranks third. In direct castings Ohio ranks first, with 54.2 per cent, and in ferrosilicon second, with 31.4 per cent. More than one-half of the ferrosilicon product is reported from Kentucky. Illinois, as in 1900, is the third in the production of Bessemer pig (16 per cent) and second in spiegeleisen (26.2 per cent). Alabama did not produce any Bessemer, but is first in foundry iron (27.9 per cent) and second in basic (11.8 per cent) and in forge (19.2 per cent). The increase in basic pig iron in Alabama over its 1900 production, 235.2 per cent, is relatively the largest for any state that produced basic pig iron in 1900. Eleven states produced Bessemer and low-phosphorus pig iron in 1905 and 12 in 1900; Kentucky, New Jersey, and North Carolina reporting Bessemer pig in 1900 but none in 1905, and Michigan and New York reporting Bessemer in 1905 but not in 1900. Basic pig iron was made in 8 states; malleable Bessemer, in 9; foundry pig, in 16; forge pig, in 10; white and mottled and miscellaneous grades, in 10; spiegeleisen, in 4; ferromanganese and ferrophosphorus each, in 1; ferrosilicon, in 3; and direct castings were made in 7 states.

The production of direct castings and spiegeleisen and ferromanganese, by kind of fuel used, is shown in Table 25.

TABLE 25.—BLAST FURNACES—QUANTITY AND VALUE OF DIRECT CASTINGS, AND SPIEGELEISEN AND FERROMANGANESE, CLASSIFIED ACCORDING TO KIND OF FUEL USED: 1905 AND 1900.

	Census.	TOTAL.		DIRECT CASTINGS.		SPIEGELEISEN AND FERROMANGANESE.	
		Tons.	Value.	Tons.	Value.	Tons.	Value.
Total	1905	[1] 237,117	$6,215,947	9,469	$131,700	[1] 227,648	$6,084,247
	1900	222,673	5,959,617	7,123	87,662	215,550	5,871,955
Mixed anthracite coal and coke	1905	44,203	881,307	(2)	....	44,203	881,307
	1900	44,293	953,489	1,080	20,830	43,213	932,659
Coke and bituminous coal	1905	192,914	5,334,640	9,469	131,700	183,445	5,202,940
	1900	178,370	5,006,007	6,033	66,711	172,337	4,939,296
Charcoal	1905	(2)	....	(2)	....	(2)	....
	1900	10	121	10	121	....	....

[1] Includes 946 tons of ferrophosphorus.

[2] None reported.

The major part of the pig iron product was made by establishments controlling steel works and rolling mills and for consumption therein. Of the 191 active blast furnace establishments, there were 52, or 27.2 per cent, which reported production of pig iron for consumption in steel works and rolling mills, foundries, etc., controlled by the reporting company. The pig iron product of these establishments amounted to 10,909,371 tons, of which 9,926,545 tons (valued at $138,867,586), or 59.7 per cent of the total tonnage produced by all establishments, was for consumption in steel works and rolling mills under the control of the same company.

The following tabular statement shows the distribution of the pig iron tonnage:

Pig iron production, distributed by classes of establishments and by states: 1905.

STATE.	PIG IRON PRODUCTION. Total.		By companies controlling steel works, rolling mills, foundries, etc.				By all other companies.	
	Number of establishments.	Tons.	Number of establishments.	Total tons.	For consumption in establishments controlled by producing company (tons).	For sale (tons).	Number of establishments.	For sale (tons).
Total	191	16,628,294	52	10,909,371	9,926,545	982,826	139	5,718,923
Ohio	33	2,987,787	12	1,944,524	1,751,730	192,794	21	1,043,263
Pennsylvania	65	7,729,278	26	6,326,215	5,573,898	752,317	39	1,403,063
All other states	93	5,911,229	14	2,638,632	2,600,917	37,715	79	3,272,597

The quantity of pig iron consumed by the steel works and rolling mills was 12,191,228 tons. Hence the pig iron consumed by companies operating steel works and rolling mills and producing their own pig iron constituted 81.4 per cent of the total pig iron so consumed and only 2,264,683 tons, or less than one-fifth, of the pig iron consumed by steel works and rolling mills was by companies not operating blast furnaces. The distribution of the pig iron product can be summarized as follows:

	Tons.
Total production	16,628,294
Consumption by steel works and rolling mills	12,191,228
Production for consumption in establishments controlled by producing company	9,926,545
Purchased from independent establishments	2,264,683
Balance available for foundries, other industries, etc.	4,437,066

Along with the development of the Bessemer and open-hearth steel processes there has resulted the practice of retaining the blast furnace metal in molten condition. For some years it has been the practice to pour the molten blast metal for use in steel manufacture into a large vessel known as a mixer or receiver. By thus mixing the tappings from several blast furnaces, the high silicon or sulphur, for example, in the metal from one furnace is compensated for by low silicon or sulphur in the iron from another, and, along with a certain amount of purification due to chemical action, produces a metal of uniform composition. Mixers capable of holding 600 tons or more of metal are now in use. They are properly, however, an adjunct of the steel plant and not of the blast furnace. The charges of metal are generally transported in large truck ladles from the blast furnace to the mixer, and often for considerable distances, without any material loss of heat.

Casting machines have also been extensively introduced and to a small extent the practice of chill casting or casting on an iron floor.

The following tabular statement shows the quantities of metal handled by the several methods, by states:

Quantity of metal, classified according to method of handling, by states: 1905.

	UNITED STATES.			OHIO.		PENNSYLVANIA.		ALL OTHER STATES.	
	Number of establishments.	Tons.	Per cent of total.	Number of establishments.	Tons.	Number of establishments.	Tons.	Number of establishments.	Tons.
Total	191	16,628,294	100.0	33	2,987,787	65	7,729,278	93	5,911,229
Sand cast	166	6,083,513	36.6	30	1,361,161	49	1,490,312	87	3,232,040
Delivered in molten condition to Bessemer converters, open-hearth furnaces, etc	25	5,898,744	35.5	7	1,105,159	11	3,579,501	7	1,214,084
Machine cast	37	4,307,108	25.9	7	516,338	21	2,376,870	9	1,413,900
Chill cast	8	329,460	2.0			4	279,654	4	49,806
Direct castings	17	9,469	[1]	5	5,129	8	2,941	4	1,399

[1] Less than one-tenth of 1 per cent.

EQUIPMENT AND PRODUCTION.

Table 26 shows, by states, ranked according to production at the census of 1905, the total number of active and idle furnaces for 1880, 1890, 1900, and 1905, with the production and the per cent of the total production.

TABLE 26.—BLAST FURNACES—NUMBER OF ACTIVE AND IDLE FURNACES AND PRODUCTION OF PIG IRON, WITH PER CENT OF TOTAL, BY STATES, RANKED ACCORDING TO QUANTITY OF PRODUCT: 1880 TO 1905.

STATE.	Census.	Completed furnaces.	PRODUCTION OF PIG IRON. Tons.	PRODUCTION OF PIG IRON. Per cent of total.	Rank.
United States	1905	435	[1] 16,628,294	100.0	
	1900	399	[1] 14,452,234	100.0	
	1890	559	[1] 8,845,185	100.0	
	1880	681	[1] 3,375,912	100.0	
Pennsylvania	1905	157	7,729,278	46.5	1
	1900	148	6,778,584	46.9	1
	1890	221	4,345,986	49.1	1
	1880	269	1,723,492	51.1	1
Ohio	1905	65	2,987,787	18.0	2
	1900	53	2,559,694	17.7	2
	1890	71	1,203,142	13.6	2
	1880	103	489,921	14.5	2
Illinois	1905	21	1,660,610	10.0	3
	1900	17	1,469,530	10.2	3
	1890	15	666,676	7.5	4
	1880	10	85,239	2.5	7
Alabama	1905	49	1,471,378	8.9	4
	1900	45	1,203,277	8.3	4
	1890	48	817,508	9.2	3
	1880	15	55,657	1.6	10
New York	1905	22	609,588	3.7	5
	1900	19	334,512	2.3	7
	1890	37	307,446	3.5	5
	1880	57	279,793	8.3	3
Tennessee	1905	22	303,624	1.8	6
	1900	19	374,249	2.6	6
	1890	19	264,187	3.0	7
	1880	21	42,744	1.3	13
Maryland	1905	6	293,481	1.8	7
	1900	7	241,172	1.7	8
	1890	14	86,282	1.0	13
	1880	22	53,271	1.6	11
Virginia	1905	26	279,103	1.7	8
	1900	26	428,117	2.9	5
	1890	31	278,899	3.2	6
	1880	31	15,988	0.5	17
Michigan	1905	11	270,933	1.6	9
	1900	13	141,377	1.0	12
	1890	26	203,417	2.3	8
	1880	27	106,774	3.2	5
West Virginia	1905	4	269,067	1.6	10
	1900	3	188,292	1.3	10
	1890	5	115,508	1.3	11
	1880	11	71,473	2.1	9
New Jersey	1905	13	262,308	1.6	11
	1900	11	150,002	1.0	11
	1890	18	129,500	1.5	10
	1880	20	140,548	4.2	4
Wisconsin	1905	6	189,141	1.1	12
	1900	6	217,451	1.5	9
	1890	10	192,092	2.2	9
	1880	14	105,609	3.1	6
Colorado	1905	5	119,874	0.7	13
	1900	2	112,843	0.8	14
	1890	2	11,562	0.1	18
Georgia	1905	4	74,504	0.4	14
	1900	5	21,505	0.1	17
	1890	5	25,099	0.3	15
	1880	10	20,624	0.6	14
Missouri	1905	2	33,481	0.2	15
	1900	2	40,975	0.3	15
	1890	8	90,205	1.0	12
	1880	17	84,866	2.5	8
Kentucky	1905	8	32,432	0.2	16
	1900	6	126,566	0.9	13
	1890	6	39,534	0.5	14
	1880	22	51,882	1.5	12
Minnesota	1905	1	20,769	0.1	17
	1900	1	29,269	0.2	16
	1890	1			
	1880	1			
Connecticut	1905	3	12,753	0.1	18
	1900	5	10,457	0.1	19
	1890	9	19,871	0.2	16
	1880	8	16,767	0.5	15
Texas	1905	4	4,669	[2]	19
	1900	4	9,789	0.1	20
	1890	3	7,991	0.1	19
	1880	1	1,250	[2]	21
Massachusetts	1905	2	3,514	[2]	20
	1900	3	3,030	[2]	21
	1890	4	7,482	0.1	21
	1880	6	8,521	0.2	18
North Carolina	1905	2			
	1900	2	11,543	0.1	18
	1890	1	3,015	[2]	24
	1880	7			
Oregon	1905	1			
	1900	1			
	1890	1	7,510	0.1	20
	1880	1	2,857	0.1	19
Washington	1905	1			
	1900	1			
	1890	1	4,274	[2]	22
Indiana	1890	2	14,696	0.2	17
	1880	4	16,283	0.5	16
Maine	1890	1	3,303	[2]	23
	1880	1	1,799	0.1	20
Vermont	1880	1	554	[2]	22
Utah	1880	2			

[1] Includes castings made direct from furnace, as follows: 1905, 9,469 tons; 1900, 7,123 tons; 1890, 5,417 tons; 1880, 3,776 tons.

[2] Less than one-tenth of 1 per cent.

During the twenty-five years covered by the statistics the production increased from 3,375,912 tons to 16,628,294 tons, while the number of furnaces decreased from 681 to 435 during the period, a loss of 246, or 36.1 per cent. This condition is the result of an increase in the capacity of the stacks, for in 1880 the average daily capacity per stack was 25 tons; in 1890, 68 tons; in 1900, 147 tons; and in 1905, 201 tons.

There has been an increase of 36 stacks since 1900—12 in Ohio; 9 in Pennsylvania; 4 each in Alabama and Illinois; 3 each in Colorado, New York, and Tennessee; 2 each in Kentucky and New Jersey; and 1 in West Virginia. A decrease is shown in Michigan and Connecticut of 2 each, and in Georgia, Maryland, and Massachusetts of 1 each.

The 4 states of Pennsylvania, Ohio, Illinois, and Alabama produced, all told, 13,849,053 tons, or 83.3 per cent of all pig iron in 1905; 83.1 per cent of the total pig iron production in 1900; 79.5 per cent in 1890; and 69.7 per cent in 1880. Of the remaining states, New York has nearly doubled its production, and Michigan, West Virginia, New Jersey, and Georgia show relatively large gains. Pennsylvania, Ohio, Illinois, and Alabama retain the same rank as in 1900. New York has advanced from seventh place to fifth, Tennessee remains sixth, and Maryland advances to seventh, while Virginia recedes from fifth to eighth.

The furnaces in North Carolina, Oregon, and Washington—2 in the former state and 1 in each of the other states—were idle in 1905. North Carolina, however, was a producer in 1900. The furnaces in Indiana, Maine, Vermont, and Utah were long since abandoned and dismantled.

Table 27 shows the number of active and idle furnaces, by states, for the census years 1900 and 1905.

Table 27.—BLAST FURNACES—NUMBER OF ACTIVE AND IDLE FURNACES, BY STATES: 1905 AND 1900.

STATE.	AGGREGATE.		ACTIVE.		IDLE.					
					Total.		In active establishments.		In idle establishments.	
	1905	1900	1905	1900	1905	1900	1905	1900	1905	1900
United States	435	399	318	326	117	73	26	18	91	55
Alabama	49	45	34	36	15	9	4	1	11	8
Colorado	5	2	3	2	2		2			
Connecticut	3	5	3	1		4		1		3
Georgia	4	5	4	3		2				2
Illinois	21	17	21	16		1		1		
Kentucky	8	6	3	5	5	1			5	1
Maryland	6	7	4	6	2	1	1		1	1
Massachusetts	2	3	1	1	1	2	1	2		
Michigan	11	13	11	7		6				6
Minnesota	1	1	1	1						
Missouri	2	2	2	2						
New Jersey	13	11	8	10	5	1			5	1
New York	22	19	15	11	7	8		1	7	7
North Carolina	2	2		2	2				2	
Ohio	65	53	52	50	13	3	1	1	12	2
Oregon	1	1			1	1			1	1
Pennsylvania	157	148	120	127	37	21	11	9	26	12
Tennessee	22	19	15	15	7	4	4	2	3	2
Texas	4	4	1	3	3	1			3	1
Virginia	26	26	11	19	15	7	2		13	7
Washington	1	1			1	1			1	1
West Virginia	4	3	4	3						
Wisconsin	6	6	5	6	1				1	

Since 1900 an increase of 43 stacks appears in certain states and a decrease of 7 stacks in other states. Of the total number of furnaces, more than one-fourth were idle. The largest number of idle stacks in any one state was in Pennsylvania—37—nearly one-fourth of the total number in the state. In Virginia more than one-half of the stacks were idle; in Alabama, nearly one-third; in Ohio, one-fifth; and in Tennessee, nearly one-third. The capacity, however, of the idle stacks is a much smaller part of the blast furnace capacity of the country than their relative numbers would indicate. The 344 furnaces owned by the active establishments, comprising 318 furnaces which were active sometime during the year, and 26 which were idle throughout the year, have a total daily capacity of 78,230 tons, or an average daily capacity of 227 tons per stack; while the 91 furnaces of the establishments idle throughout the year have an aggregate daily capacity of 9,268 tons, or an average of 102 tons per stack. Of the furnaces of idle establishments, 18 were charcoal furnaces, with an aggregate daily capacity of 666 tons, or an average of 37 tons. The idle furnaces of the active establishments are as a rule the smaller furnaces, and below the average in capacity. If, however, the 26 idle furnaces owned by active establishments are given the average capacity of all furnaces owned by the active establishments—227 tons—and their capacity as thus estimated is added to that of the

idle establishments, we obtain a little over 15,000 tons as the total daily capacity of all idle furnaces, or between one-sixth and one-fifth of the total furnace capacity.

Table 28 shows, according to the kind of fuel used, the total number of blast furnaces in the United States for the census years 1880, 1890, 1900, and 1905, whether active or idle, and their daily capacity in gross tons, by states.

TABLE 28.—BLAST FURNACES—NUMBER AND CAPACITY OF COMPLETED FURNACES, CLASSIFIED ACCORDING TO KIND OF FUEL USED, BY STATES: 1880 TO 1905.

STATE.	Census.	TOTAL.		COKE AND BITUMINOUS COAL FURNACES.		ANTHRACITE AND MIXED ANTHRACITE AND COKE FURNACES.		CHARCOAL FURNACES.	
		Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).
United States	1905	435	87,498	306	76,249	74	8,709	55	2,540
	1900	[1] 399	58,569	[1] 240	46,577	93	9,311	66	2,681
	1890	559	37,889	249	25,162	170	9,349	140	3,378
	1880	681	17,186	199	7,473	231	6,761	251	2,952
Alabama	1905	49	7,665	43	7,355	....	....	6	310
	1900	45	6,103	37	5,743	....	....	8	360
	1890	48	3,783	34	3,242	....	....	14	541
	1880	15	303	5	161	....	....	10	142
Colorado	1905	5	1,600	5	1,600	....	....	....	....
	1900	2	400	2	400	....	....	....	....
	1890	2	196	2	196	....	....	....	....
Connecticut	1905	3	46	....	....	....	....	3	46
	1900	5	75	....	....	....	....	5	75
	1890	9	115	....	....	....	....	9	115
	1880	8	81	....	....	....	....	8	81
Georgia	1905	4	300	1	150	....	....	3	150
	1900	5	300	2	185	....	....	3	115
	1890	5	231	2	156	....	....	3	75
	1880	10	129	2	67	....	....	8	62
Illinois	1905	21	6,752	21	6,752	....	....	....	....
	1900	17	4,408	17	4,408	....	....	....	....
	1890	15	2,475	15	2,475	....	....	....	....
	1880	10	538	10	538	....	....	....	....
Indiana	1890	2	54	2	54	....	....	....	....
	1880	4	65	3	52	....	....	1	13
Kentucky	1905	8	675	8	675	....	....	....	....
	1900	6	525	6	525	....	....	....	....
	1890	6	288	5	273	....	....	1	15
	1880	22	350	4	167	....	....	18	183
Maine	1890	1	16	....	....	....	....	1	16
	1880	1	16	....	....	....	....	1	16
Maryland	1905	6	1,270	5	1,250	....	....	1	20
	1900	7	1,080	5	1,030	....	....	2	50
	1890	14	637	4	470	3	67	7	100
	1880	22	251	4	51	5	99	13	101
Massachusetts	1905	2	24	....	....	....	....	2	24
	1900	3	40	....	....	....	....	3	40
	1890	4	49	....	....	....	....	4	49
	1880	6	72	....	....	1	25	5	47
Michigan	1905	11	1,137	1	250	....	....	10	887
	1900	13	930	....	....	....	....	13	930
	1890	26	1,086	....	....	....	....	26	1,086
	1880	27	754	....	....	2	121	25	633
Minnesota	1905	1	225	1	225	....	....	....	....
	1900	1	75	1	75	....	....	....	....
	1890	1	134	1	134	....	....	....	....
	1880	1	36	....	....	....	....	1	36
Missouri	1905	2	225	1	150	....	....	1	75
	1900	2	200	1	150	....	....	1	50
	1890	8	491	5	384	....	....	3	107
	1880	17	669	8	447	....	....	9	222
New Jersey	1905	13	1,647	4	930	9	717	....	....
	1900	11	817	1	55	10	762	....	....
	1890	18	827	....	....	18	827	....	....
	1880	20	617	....	....	20	617	....	....
New York	1905	22	3,940	10	2,920	8	795	4	225
	1900	19	2,580	4	850	13	1,700	2	30
	1890	37	1,883	4	616	24	1,119	9	148
	1880	57	1,477	....	....	42	1,323	15	154
North Carolina	1905	2	62	2	62	....	....	....	....
	1900	2	62	2	62	....	....	....	....
	1890	1	13	....	....	....	....	1	13
	1880	7	35	....	....	....	....	7	35

[1] Includes 5 mixed charcoal and coke furnaces of a daily capacity of 350 tons.

TABLE 28.—BLAST FURNACES—NUMBER AND CAPACITY OF COMPLETED FURNACES, CLASSIFIED ACCORDING TO KIND OF FUEL USED, BY STATES: 1880 TO 1905—Continued.

STATE.	Census.	TOTAL.		COKE AND BITUMINOUS COAL FURNACES.		ANTHRACITE AND MIXED ANTHRACITE AND COKE FURNACES.		CHARCOAL FURNACES.	
		Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).
Ohio	1905	65	16,734	59	16,645			6	89
	1900	53	10,500	47	10,360			6	140
	1890	71	5,101	60	4,981			11	120
	1880	103	2,858	70	2,470			33	388
Oregon	1905	1	50					1	50
	1900	1	50					1	50
	1890	1	38					1	38
	1880	1	11					1	11
Pennsylvania	1905	157	37,845	95	30,601	57	7,197	5	47
	1900	148	24,070	70	17,119	70	6,849	8	102
	1890	221	17,047	81	9,551	125	7,336	15	160
	1880	269	7,580	75	2,953	158	4,411	36	216
Tennessee	1905	22	2,352	19	2,174			3	178
	1900	[1] 19	2,270	[1] 16	1,955			3	315
	1890	19	990	12	818			7	172
	1880	21	346	5	199			16	147
Texas	1905	4	210					4	210
	1900	4	175					4	175
	1890	3	116					3	116
	1880	1	9					1	9
Utah	1880	2	16					2	16
Vermont	1880	1	10					1	10
Virginia	1905	26	2,619	22	2,550			4	69
	1900	26	2,374	21	2,280			5	94
	1890	31	1,071	13	928			18	143
	1880	31	256	7	109			24	147
Washington	1905	1	35					1	35
	1900	1	35					1	35
	1890	1	27					1	27
West Virginia	1905	4	1,125	4	1,125				
	1900	3	750	3	750				
	1890	5	469	5	469				
	1880	11	285	6	259			5	26
Wisconsin	1905	6	960	5	835			1	125
	1900	6	750	5	630			1	120
	1890	10	752	4	415			6	337
	1880	14	422			3	165	11	257

[1] Includes 5 mixed charcoal and coke furnaces of a daily capacity of 350 tons.

For the first time since 1880 there appears an increase in the total number of blast furnaces, the number having increased from 399 to 435 since 1900. With each former census the decrease in number of stacks was large, accompanied by an increase both in aggregate capacity and in average capacity per stack. But during the period from 1900 to 1905 the number of stacks increased 9 per cent, the aggregate capacity 49.4 per cent, and the average capacity 36.7 per cent. The gain was in coke furnaces. Charcoal furnaces decreased in number, with a slight increase in the average daily capacity; and the anthracite and mixed anthracite and coke furnaces decreased considerably both in number and in aggregate capacity. In 1900, 5 furnaces in Tennessee, of a daily capacity of 350 tons, were operated with mixed charcoal and coke fuel. No furnaces operated with mixed charcoal and coke fuel were reported in 1905.

The growth in the size of furnaces is shown by the following presentation of the average daily capacity of furnaces for the different fuels and for the different census years:

	AVERAGE DAILY CAPACITY IN TONS.			
	1905	1900	1890	1880
All furnaces	201	147	68	25
Coke and bituminous coal furnaces	249	194	101	35
Anthracite and mixed anthracite and coke furnaces	118	100	55	29
Charcoal furnaces	46	41	24	12

The changes going on in furnace equipment—that is, the decrease in the number of anthracite and charcoal furnaces and the increase of the coke furnaces—is readily seen by reference to the table. New York alone shows an increase in charcoal furnaces. New

idle establishments, we obtain a little over 15,000 tons as the total daily capacity of all idle furnaces, or between one-sixth and one-fifth of the total furnace capacity.

Table 28 shows, according to the kind of fuel used, the total number of blast furnaces in the United States for the census years 1880, 1890, 1900, and 1905, whether active or idle, and their daily capacity in gross tons, by states.

TABLE 28.—BLAST FURNACES—NUMBER AND CAPACITY OF COMPLETED FURNACES, CLASSIFIED ACCORDING TO KIND OF FUEL USED, BY STATES: 1880 TO 1905.

STATE.	Census.	TOTAL.		COKE AND BITUMINOUS COAL FURNACES.		ANTHRACITE AND MIXED ANTHRACITE AND COKE FURNACES.		CHARCOAL FURNACES.	
		Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).
United States	1905	435	87,498	306	76,249	74	8,709	55	2,540
	1900	[1] 399	58,569	[1] 240	46,577	93	9,311	66	2,681
	1890	559	37,889	249	25,162	170	9,349	140	3,378
	1880	681	17,186	199	7,473	231	6,761	251	2,952
Alabama	1905	49	7,665	43	7,355	....	....	6	310
	1900	45	6,103	37	5,743	....	....	8	360
	1890	48	3,783	34	3,242	....	....	14	541
	1880	15	303	5	161	....	....	10	142
Colorado	1905	5	1,600	5	1,600	....	....	....	....
	1900	2	400	2	400	....	....	....	....
	1890	2	196	2	196	....	....	....	....
Connecticut	1905	3	46	....	....	....	....	3	46
	1900	5	75	....	....	....	....	5	75
	1890	9	115	....	....	....	....	9	115
	1880	8	81	....	....	....	....	8	81
Georgia	1905	4	300	1	150	....	....	3	150
	1900	5	300	2	185	....	....	3	115
	1890	5	231	2	156	....	....	3	75
	1880	10	129	[illegible]	67	....	....	8	62
Illinois	1905	21	6,752	21	6,752	....	....	....	....
	1900	17	4,408	17	4,408	....	....	....	....
	1890	15	2,475	15	2,475	....	....	....	....
	1880	10	538	10	538	....	....	....	....
Indiana	1890	2	54	2	54	....	....	....	....
	1880	4	65	3	52	....	....	1	13
Kentucky	1905	8	675	8	675	....	....	....	....
	1900	6	525	6	525	....	....	....	....
	1890	6	288	5	273	....	....	1	15
	1880	22	350	4	167	....	....	18	183
Maine	1890	1	16	....	....	....	....	1	16
	1880	1	16	....	....	....	....	1	16
Maryland	1905	6	1,270	5	1,250	....	....	1	20
	1900	7	1,080	5	1,030	....	....	2	50
	1890	14	637	4	470	3	67	7	100
	1880	22	251	4	51	5	99	13	101
Massachusetts	1905	2	24	....	....	....	....	2	24
	1900	3	40	....	....	....	....	3	40
	1890	4	49	....	....	....	....	4	49
	1880	6	72	....	....	1	25	5	47
Michigan	1905	11	1,137	1	250	....	....	10	887
	1900	13	930	....	....	....	....	13	930
	1890	26	1,086	....	....	....	....	26	1,086
	1880	27	754	....	....	2	121	25	633
Minnesota	1905	1	225	1	225	....	....	....	....
	1900	1	75	1	75	....	....	....	....
	1890	1	134	1	134	....	....	....	....
	1880	1	36	....	....	....	....	1	36
Missouri	1905	2	225	1	150	....	....	1	75
	1900	2	200	1	150	....	....	1	50
	1890	8	491	5	384	....	....	3	107
	1880	17	669	8	447	....	....	9	222
New Jersey	1905	13	1,647	[illegible]	930	9	717	....	....
	1900	11	817	1	55	10	762	....	....
	1890	18	827	....	....	18	827	....	....
	1880	20	617	....	....	20	617	....	....
New York	1905	22	3,940	10	2,920	8	795	4	225
	1900	19	2,580	4	850	13	1,700	2	30
	1890	37	1,883	4	616	24	1,119	9	148
	1880	57	1,477	....	....	42	1,323	15	154
North Carolina	1905	[illegible]	62	2	62				
	1900	[illegible]	62	2	62	....	....	....	....
	1890	1	13	....	....	....	....	....	....
	1880	7	35	....	....	....	....	1	13
								7	35

[1] Includes 5 mixed charcoal and coke furnaces of a daily capacity of 350 tons.

TABLE 28.—BLAST FURNACES—NUMBER AND CAPACITY OF COMPLETED FURNACES, CLASSIFIED ACCORDING TO KIND OF FUEL USED, BY STATES: 1880 TO 1905—Continued.

STATE.	Census.	TOTAL.		COKE AND BITUMINOUS COAL FURNACES.		ANTHRACITE AND MIXED ANTHRACITE AND COKE FURNACES.		CHARCOAL FURNACES.	
		Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).
Ohio	1905	65	16,734	59	16,645			6	89
	1900	53	10,500	47	10,360			6	140
	1890	71	5,101	60	4,981			11	120
	1880	103	2,858	70	2,470			33	388
Oregon	1905	1	50					1	50
	1900	1	50					1	50
	1890	1	38					1	38
	1880	1	11					1	11
Pennsylvania	1905	157	37,845	95	30,601	57	7,197	5	47
	1900	148	24,070	70	17,119	70	6,849	8	102
	1890	221	17,047	81	9,551	125	7,336	15	160
	1880	269	7,580	75	2,953	158	4,411	36	216
Tennessee	1905	22	2,352	19	2,174			3	178
	1900	[1] 19	2,270	[1] 16	1,955			3	315
	1890	19	990	12	818			7	172
	1880	21	346	5	199			16	147
Texas	1905	4	210					4	210
	1900	4	175					4	175
	1890	3	116					3	116
	1880	1	9					1	9
Utah	1880	2	16					2	16
Vermont	1880	1	10					1	10
Virginia	1905	26	2,619	22	2,550			4	69
	1900	26	2,374	21	2,280			5	94
	1890	31	1,071	13	928			18	143
	1880	31	256	7	109			24	147
Washington	1905	1	35					1	35
	1900	1	35					1	35
	1890	1	27					1	27
West Virginia	1905	4	1,125	4	1,125				
	1900	3	750	3	750				
	1890	5	469	5	469				
	1880	11	285	6	259			5	26
Wisconsin	1905	6	960	5	835			1	125
	1900	6	750	5	630			1	120
	1890	10	752	4	415			6	337
	1880	14	422			3	165	11	257

[1] Includes 5 mixed charcoal and coke furnaces of a daily capacity of 350 tons.

For the first time since 1880 there appears an increase in the total number of blast furnaces, the number having increased from 399 to 435 since 1900. With each former census the decrease in number of stacks was large, accompanied by an increase both in aggregate capacity and in average capacity per stack. But during the period from 1900 to 1905 the number of stacks increased 9 per cent, the aggregate capacity 49.4 per cent, and the average capacity 36.7 per cent. The gain was in coke furnaces. Charcoal furnaces decreased in number, with a slight increase in the average daily capacity; and the anthracite and mixed anthracite and coke furnaces decreased considerably both in number and in aggregate capacity. In 1900, 5 furnaces in Tennessee, of a daily capacity of 350 tons, were operated with mixed charcoal and coke fuel. No furnaces operated with mixed charcoal and coke fuel were reported in 1905.

The growth in the size of furnaces is shown by the following presentation of the average daily capacity of furnaces for the different fuels and for the different census years:

	AVERAGE DAILY CAPACITY IN TONS.			
	1905	1900	1890	1880
All furnaces	201	147	68	25
Coke and bituminous coal furnaces	249	194	101	38
Anthracite and mixed anthracite and coke furnaces	118	100	55	29
Charcoal furnaces	46	41	24	12

The changes going on in furnace equipment—that is, the decrease in the number of anthracite and charcoal furnaces and the increase of the coke furnaces—is readily seen by reference to the table. New York alone shows an increase in charcoal furnaces. New

Jersey, New York, and Pennsylvania, the only states having anthracite and mixed anthracite and coke furnaces in 1900, all show reduced numbers in 1905.

Pennsylvania shows an increase of 25 bituminous (coke) furnaces since 1900, with an increase in average daily capacity per stack from 245 tons in 1900 to 322 tons in 1905. Ohio has an increase of 12 stacks, with an increase in average daily capacity from 220 tons in 1900 to 282 tons in 1905. New York shows an increase of 6 stacks, and an increase in average daily capacity of from 212 tons in 1900 to 292 tons in 1905. Alabama shows an increase of 6 stacks, with an increase in average daily capacity from 155 tons in 1900 to 171 tons in 1905. Illinois has gained 4 stacks, and increased the average daily capacity of its furnaces from 259 tons in 1900 to 322 tons in 1905. Similar gains are shown for Colorado, New Jersey, Kentucky, Michigan, Virginia, and West Virginia; the state of Michigan for the first time reporting a bituminous fuel furnace.

There are reported 31 furnaces of a daily capacity rating of 500 tons or more, distributed as follows: Pennsylvania 21, with an aggregate daily capacity of 11,700 tons; Ohio 7, with an aggregate daily capacity of 3,500 tons; Illinois 2, of 500 tons each; and New York 1, of 600 tons. The largest furnaces are Stacks J and K of the Edgar Thomson group of the Carnegie Steel Company, each of 650 tons rating.

In the presentation of statistics for the census of 1900 mention was made of the production of 901 gross tons of pig iron in a single day in June, 1902, by Furnace E of the Edgar Thomson group of the Carnegie Steel Company, at Bessemer, Pa. This output was exceeded by the same furnace on March 30, 1905, when it produced 918 gross tons of Bessemer pig iron. This is, up to the present time, the world's record for the largest output by a single furnace in twenty-four hours.

At the time of taking the present census the world's record for the longest run was held by Furnace H of the Edgar Thomson group, which was blown in on March 13, 1894, and blown out on June 20, 1903, a run of 3,386 days, during which period it was banked once for thirty-five days. The output of the furnace for the run was 1,256,193 gross tons of pig iron, an average of 374.9 tons per day for the 3,351 days of operating time. The record has since been surpassed by Shoenberger Furnace No. 2, Pittsburg, Pa., of the American Steel and Wire Company, which was blown out on August 1, 1906, after having been in blast for 3,427 days. During this time it was banked twelve times for an aggregate of sixty-six days.

The record for the largest output on a single lining is held by the Duquesne Furnace No. 1 of the Carnegie Steel Company, which produced 1,287,381 gross tons on an unbroken run of 2,024 days—an average of 636.1 tons per day.

Slag pits.—The schedule for the present census contained, for the first time, inquiries in regard to the number of granulated slag pits in use, their capacity, and the purposes for which the granulated slag is used; also the extent of manufacture of cement from slag by blast furnace establishments.

The use of granulated slag pits was reported by 31 establishments, distributed as follows: Pennsylvania, 15; Ohio, 14; Illinois, 1; and New York, 1. These establishments had in the aggregate 47 slag pits, with an annual capacity of 3,338,200 tons. Four of the establishments, located, 1 in Illinois, 2 in Ohio, and 1 in Pennsylvania, reported the use of slag for cement manufacture by the producing company, the cement plants having an annual capacity in excess of 5,000,000 barrels. In addition, 2 establishments reported the sale of slag to cement works. The bulk of the granulated slag is used for filling and railroad ballast.

PIG IRON EXPORTED.

In collecting the statistics for the census of 1900 an inquiry was made as to the amount of pig iron exported by blast furnace establishments, but this inquiry was omitted in taking the census of 1905. The total quantity reported as exported direct by blast furnace establishments in 1900 was 166,625 tons, which was less than 1.2 per cent of the total production. The total amount of pig iron exported in 1901, according to the reports of the Secretary of the Treasury, was 255,253 tons; in 1902 it had declined to 54,704 tons; it was still less in 1903 and 1904; and in 1905 it was only 56,971 tons, or less than three-tenths of 1 per cent of the total production.

POWER.

The blast furnace establishments in operation in 1904 reported in power equipment 1,555 steam engines, with an aggregate of 762,382 horsepower; 27 gas and gasoline engines, having 3,757 horsepower; 21 water wheels, of 680 horsepower; 1,370 electric motors, of 52,471 horsepower; miscellaneous power appliances, of 6,320 horsepower; and 139 electric horsepower rented. These aggregate 825,749 horsepower, as compared with 505,965 horsepower reported at the census of 1900, an increase of 63.2 per cent. In addition, 1 penal institution in Texas reported 5 steam engines with 550 horsepower.

The use of waterpower was reported by 2 active establishments in Connecticut, 1 in Georgia, 2 in Michigan, and 4 in Pennsylvania, and by 1 idle establishment in North Carolina and 1 in Virginia. With the exception of 2 active establishments in Pennsylvania and 1 idle in Virginia, all those which reported waterpower have steampower equipment also.

The idle blast furnace establishments reported 250 steam engines of 89,465 horsepower, 2 water wheels

of 82 horsepower, and 2 electric motors of 78 horsepower—a total of 89,625 horsepower.

The 1,372 electric motors of 52,549 horsepower capacity owned by the active and idle establishments represent secondary power, as they are run by current generated by the establishments reporting. The primary power of all establishments is therefore 863,375 horsepower. This shows an average power equipment of 1,985 horsepower per stack, and of 9.9 horsepower per ton of stack capacity.

In 1900 the corresponding average power equipment per stack was 1,312 horsepower, and per ton of stack capacity it was 8.9 horsepower.

The size of steam engines used (active establishments) has increased from an average of 381 horsepower in 1900 to 489 horsepower in 1905.

THE MANUFACTURE OF PIG IRON WITH MINERAL FUEL.

In 1880 nearly one-half of the pig iron product was made with anthracite fuel—either anthracite alone or anthracite coal and coke mixed. During the following decade bituminous coal and coke forged ahead and outstripped anthracite fuel, and at the present time pig iron made with bituminous fuel constitutes nearly nine-tenths of the total production.

In 1905 the production of anthracite pig iron was but 30,373 tons, and that of pig iron made with mixed anthracite coal and coke had declined from 1,796,000 tons in 1900 to 1,274,721 tons in 1905, a decrease of 29 per cent.

The increase in coke and bituminous coal pig iron, which was very heavy from 1890 to 1900, has continued, and during the period 1900 to 1905 the increase amounted to 2,655,211 tons, or 21.7 per cent. Bituminous pig iron exceeded anthracite in 1905 by 13,603,935 tons.

Table 29 shows the leading statistics of the manufacture of pig iron with mineral fuel for the census years of 1880, 1890, 1900, and 1905.

TABLE 29.—BLAST FURNACES, MINERAL FUEL—COMPARATIVE SUMMARY, WITH PER CENT OF INCREASE: 1880 TO 1905.

	CENSUS.				PER CENT OF INCREASE.		
	1905	1900	1890	1880	1900 to 1905	1890 to 1900	1880 to 1890
Number of establishments	160	188	221	225	[1] 14.9	[1] 14.9	[1] 1.8
Capital	[2] $228,895,148	[2] $140,703,112	[2] $116,982,231	$70,262,615	62.7	20.3	66.5
Salaried officials, clerks, etc., number	2,031	1,580	[3] 809	(4)	28.5	95.3	....
Salaries	$2,630,547	$2,104,170	[3] $1,258,596	(4)	25.0	67.2	....
Wage-earners, average number	32,873	37,425	30,148	25,025	[1] 12.2	24.1	20.5
Total wages	$17,970,879	$17,849,770	$13,418,450	$8,554,152	0.7	33.0	56.9
Men 16 years and over	32,799	37,338	30,083	(4)	[1] 12.2	24.1	....
Wages	$17,954,249	$17,830,986	$13,406,085	(4)	0.7	33.0	....
Women 16 years and over	4	6	....	(4)	[1] 33.3	....	....
Wages	$954	$1,352	....	(4)	[1] 29.4	....	....
Children under 16 years	70	81	65	(4)	[1] 13.6	24.6	....
Wages	$15,676	$17,432	$12,365	(4)	[1] 10.1	41.0	....
Miscellaneous expenses	$9,396,115	$7,181,322	$5,330,720	(5)	30.8	34.7	....
Cost of materials used	$173,885,724	$127,706,216	$101,719,465	$51,254,711	36.2	25.5	98.5
Value of products	$224,433,959	$200,676,934	$133,685,378	$76,739,573	11.8	50.1	74.2
Tons of pig iron	16,214,123	14,095,675	8,251,693	2,987,235	15.0	70.8	176.2

[1] Decrease.
[2] Includes value of rented property—1905, $2,528,600; 1900, $4,623,081; 1890, $4,807,470.
[3] Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905, but not included in this table.
[4] Not reported separately.
[5] Not reported.

The number of establishments shows a decrease for each census year, while the capital investment and production shows a constant increase; though, as before explained, through the more general installation of labor saving equipments, the increased production is secured with a considerably less number of wage-earners. The number of active establishments has decreased 28 in number from 1900 to 1905, while the capital invested has increased $88,192,036, or 62.7 per cent. The decrease in number of wage-earners was 4,552, or 12.2 per cent.

In 1890 the yearly pig iron product per wage-earner was 274 tons; in 1900, 377 tons; and at the census of 1905 this average shows a further increase to 493 tons.

The following tabular statement shows, per ton of pig iron produced with mineral fuel, the capital investment, cost of production as shown by the items reported, and value of all products, for 1890, 1900, and 1905:

	1905	1900	1890
Capital	$14.12	$9.98	$14.18
Expenses	12.58	10.99	14.75
Salaries	0.16	0.15	0.15
Wages paid	1.11	1.27	1.63
Miscellaneous expenses	0.58	0.51	0.64
Cost of materials used	10.73	9.06	12.33
Products, value per ton	13.84	14.24	16.20

It will be observed that executive and superintendence expense, as represented by salaries paid and miscellaneous expense, varies comparatively little per ton of product, while the labor item decreases with each

census. The fluctuations in the cost of production are due chiefly to fluctuations in the cost of materials.

In 1890 and 1900 the labor cost of producing a ton of mineral fuel pig iron, as represented by the amount of wages paid at the blast furnaces, was between 11 and 12 per cent of the cost represented by the above items, while in 1905 it was a trifle less than 9 per cent.

Table 30 is a comparative summary, by states, of the leading statistics of establishments manufacturing pig iron with mineral fuel, for 1880, 1890, 1900, and 1905.

TABLE 30.—BLAST FURNACES, MINERAL FUEL—COMPARATIVE SUMMARY, BY STATES: 1880 TO 1905.

STATE.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
				Number.	Salaries.	Average number.	Wages.			
United States	1905	160	[1] $228,895,148	2,031	$2,630,547	32,873	$17,970,879	$9,390,115	$173,885,724	$224,433,959
	1900	188	[1] 140,703,112	1,580	2,104,170	37,425	17,849,770	7,181,322	127,706,216	200,676,934
	1890	221	[1] 116,982,231	[2] 809	[2] 1,258,596	30,148	13,418,450	5,330,720	101,719,465	133,685,378
	1880	225	70,262,615	(3)	( )	25,025	8,554,152	(4)	51,254,711	76,739,573
Alabama [5]	1900	15	10,512,495	123	203,564	4,804	1,306,929	753,119	7,110,092	12,645,970
	1890	17	12,466,870	103	183,874	3,364	1,305,835	(3)	5,194,859	8,390,604
	1880	2	955,800			300	60,257		233,353	554,162
Illinois	1905	4	14,263,055	83	100,661	1,910	1,397,969	958,945	19,005,423	27,330,836
	1900	4	10,683,913	210	294,524	3,010	2,176,274	691,724	11,707,965	15,153,646
	1890	5	9,855,274	11	23,115	1,420	896,030	(3)	8,088,153	10,138,310
	1880	3	950,000			498	185,054		1,762,609	2,391,850
Missouri [6]	1890	3	1,262,475	10	16,343	383	156,020	(3)	900,319	1,191,502
	1880	2	2,050,000			479	169,111		1,410,124	1,765,017
New Jersey	1905	5	5,414,051	32	43,715	774	370,751	191,355	2,940,780	3,601,511
	1900	9	2,474,639	50	44,888	589	292,213	90,619	1,987,594	2,546,215
	1890	8	3,131,366	15	22,386	640	240,152	(3)	1,679,937	2,228,724
	1880	12	3,644,500			1,174	365,639		2,488,670	3,428,747
New York	1905	8	14,514,587	70	147,832	1,473	1,098,135	281,734	5,978,098	8,152,445
	1900	7	3,781,141	41	77,549	998	620,983	283,351	3,371,684	4,860,154
	1890	13	5,850,119	47	84,381	1,338	550,018	(3)	3,964,464	4,850,543
	1880	22	8,059,384			2,050	762,210		3,712,160	6,009,097
Ohio [5]	1900	39	22,823,130	266	333,281	5,882	3,257,644	1,242,779	23,438,764	40,191,687
	1890	37	10,985,403	138	176,115	3,801	1,795,576	(3)	15,387,430	19,355,162
	1880	45	10,022,586			5,514	1,752,741		8,233,013	11,646,754
Pennsylvania	1905	61	109,098,701	883	1,104,691	13,838	7,753,725	4,575,234	86,274,037	107,380,293
	1900	74	74,675,948	604	780,412	15,999	8,015,784	3,263,669	64,016,952	101,455,104
	1890	105	58,494,262	341	545,070	15,411	7,047,156	(3)	56,922,660	74,837,755
	1880	116	39,048,294			11,975	4,368,562		29,087,348	44,385,123
Tennessee [5]	1900	8	3,906,879	53	73,206	1,484	347,907	191,324	2,564,970	3,856,913
	1890	7	2,827,085	44	60,106	811	357,883	(3)	2,018,044	2,702,548
	1880	3	810,626			623	145,867		393,685	640,957
Virginia [5]	1900	15	4,958,992	115	144,654	1,575	523,367	158,768	4,352,605	6,459,970
	1890	10	3,874,606	49	71,177	1,167	456.001	(3)	2,720,195	3,755,651
	1880	1	500,000			200	94,781		76,179	178,920
West Virginia [5]	1900	3	1,080,553	24	21,051	492	227,235	58,787	1,693,042	3,119,301
	1890	4	1,446,082	13	16,758	411	182,175	(3)	1,503,847	2,009,505
	1880	6	1,254,425			608	211,484		1,131,176	1,583,896
Wisconsin [5]	1900	4	1,361,096	19	29,485	469	259,131	96,355	1,667,762	2,369,687
	1890	3	2,284,509	8	12,294	328	147,154	(3)	1,294,123	1,620.117
	1880	1	600,000			235	115,537		1,198,670	1,688,655
All other states	[7] 1905	82	85,604,754	963	1,233,648	14,878	7,350,299	3,388,847	59,687,386	77,968,874
	[8] 1900	10	4,444,326	75	101,556	2,123	822,303	350,827	5,794,786	8,018,287
	[9] 1890	9	4,504,180	30	46,977	1,074	284,450	(3)	2,045,434	2,604,957
	[10] 1880	12	2,367,000			1,369	322,909		1,527,724	2,466,395

1 Includes value of rented property—1905, $2,528,600; 1900, $4,623,081; 1890, $4,807,470.
2 Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905, but not included in this table.
3 Not reported separately.
4 Not reported.
5 Included in "all other states" in 1905.
6 Included in "all other states" in 1900 and 1905.
7 Includes establishments distributed as follows: Alabama, 17; Colorado, 1; Georgia 1; Kentucky, 1; Maryland, 1; Michigan, 1; Minnesota, 1; Missouri, 1; Ohio, 31; Tennessee, 12; Virginia, 9; West Virginia, 3; Wisconsin, 3.
8 Includes establishments distributed as follows: Colorado, 1; Georgia, 1; Kentucky, 2; Maryland, 2; Minnesota, 1; Missouri, 1; North Carolina, 2.
9 Includes establishments distributed as follows: Colorado, 1; Georgia, 2; Indiana, 2; Kentucky, 2; Maryland, 2.
10 Includes establishments distributed as follows: Georgia, 2; Indiana, 2; Kentucky, 3; Maryland, 4; Massachusetts, 1.

The necessity of including in the group of "all other states" such states as have establishments owned by less than three organizations in either the mineral-fuel branch or the charcoal-fuel branch of the blast furnace industry, in order that the operations of individual organizations may not be disclosed by comparison of the different tables, requires the inclusion under "all other states" of a number of the leading states; notably Ohio and Alabama, which are the second and fourth ranking states, respectively, in the mineral fuel industry, as well as West Virginia, Tennessee, Virginia, and Wisconsin, which rank sixth, eighth, ninth, and tenth, respectively.

Pig iron was produced with mineral fuel in 17 states in 1905. The number is the same as in 1900, Michigan, which did not produce mineral fuel pig iron in 1900,

appearing as a producer in 1905 and replacing North Carolina, whose furnaces, active in 1900, were idle in 1905. There were 16 states that produced mineral fuel pig iron in 1890 and 1880. All of the states for which product value is given in detail show an increase. The largest relative increase in value of product for the period 1900 to 1905 appears in Illinois and the next in New York; the per cent of increase was 80.4 in the former state and 67.8 in the latter. Next in order comes New Jersey, with an increase in value of products of 41.4 per cent, followed by Alabama, which showed a large increase.

It should be noted, however, that the statistics of Illinois for 1900 show an average value per ton of pig iron made with mineral fuel of $10.23 (see Table 34), which is $3.99 per ton less than the average value for the United States, and $4.74 per ton less than the average for Pennsylvania. It is probable that the low average value per ton for pig iron in Illinois in 1900 was due to a misunderstanding of the scope of the census inquiry and to errors in reporting values. If we estimate the value of the Illinois pig iron product for 1900 on the basis of the average value for the United States, $14.22 per ton, we have $20,896,717, instead of $15,033,696, as the value of the pig iron product made with mineral fuel.

The decrease in the number of wage-earners in the blast furnace industry in general has heretofore been noted.

The total value of all products reported by blast furnace establishments in 1905 was $231,889,126, of which amount the mineral fuel furnaces contributed $224,433,959, or 96.8 per cent, compared with 97 per cent in 1900, 91.8 per cent in 1890, and 85.9 per cent in 1880. The state of Pennsylvania produced nearly one-half of the mineral fuel pig iron, and over five-sixths of the entire product was from Pennsylvania, Ohio, Illinois, and Alabama.

Capital.—Table 31 shows the capital invested in blast furnace establishments equipped for the manufacture of mineral fuel pig iron, whether active or idle, for the census years 1880, 1890, 1900, and 1905.

TABLE 31.—*Blast furnaces, mineral fuel—active and idle establishments—capital: 1880 to 1905.*

	Census.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, cash, and sundries.
Total	1905	216	[1] $249,101,969	$148,287,198	$100,814,771
	1900	207	[1] 146,556,052	80,989,287	65,566,765
	1890	261	[1] 121,393,241	67,102,965	54,290,276
	1880	271	76,095,698	40,503,972	35,591,726
Active	1905	160	228,895,148	133,280,465	95,614,683
	1900	188	140,703,112	76,415,732	64,287,380
	1890	221	116,982,231	63,798,965	53,183.266
	1880	225	70,262,615	36,605,322	33,657,293
Idle	1905	56	20,206,821	15,006,733	5,200,088
	1900	19	5,852,940	4,573,555	1,279,385
	1890	40	4,411,010	3,304,000	1,107,010
	1880	46	5,833,083	3,898,650	1,934,433

[1] Includes value of rented property—1905, $3,359,600; 1900, $4,763,381; 1890, $4,807,470.

The total capital invested in the mineral fuel branch of the blast furnace industry constitutes 94.9 per cent of the capital in the entire industry, as compared with 92.6 per cent in 1900. In 1890 the percentage was 86.1.

Materials used.—Table 32 shows in detail the quantity and cost of the materials used by the mineral fuel blast furnaces in the manufacture of pig iron in 1880, 1890, 1900, and 1905.

TABLE 32.—BLAST FURNACES, MINERAL FUEL—MATERIALS USED, BY KIND, QUANTITY, AND COST: 1880 TO 1905.

KIND.	1905		1900		1890		1880	
	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.
Total	....	$173,885,724	....	$127,706,216	....	$101,719,465	....	$51,254,711
Domestic iron ore	28,393,506	94,173,650	23,916,749	60,595,698	12,886,878	54,006,644	5,642,529	29,689,649
Foreign iron ore	829,918	4,739,123	754,383	4,107,449	965,741	5,860,349	([1])	([1])
Fluxing material	8,256,325	6,821,558	7,223,136	4,980,465	4,885,153	4,038,709	2,727,216	2,446,767
Anthracite coal and culm	560,637	1,812,779	886,564	2,297,419	1,796,854	5,165,761	2,334,984	8,012,755
Bituminous coal and slack	796,113	1,323,646	831,429	1,099,810	491,971	759,522	939,065	2,095,887
Coke	[2] 19,739,671	57,126,997	[2] 16,396,455	38,774,819	[2] 9,237,935	27,435,780	[2] 2,128,255	8,129,240
Mill cinder, scrap, etc.	1,864,836	3,828,916	1,599,364	3,769,161	1,144,974	3,084,391	302,136	841,451
All other materials	....	4,059,055	....	12,081,395	....	1,368,309	....	38,962

[1] Domestic and foreign ore were not reported separately in 1880.

[2] Short tons.

The consumption of domestic iron ore shows an increase of 4,476,757 tons, or 18.7 per cent; foreign iron ore, an increase of 75,535 tons, or 10 per cent; and mill cinder and scrap reported as purchased—that is, not including runner or other scrap produced by the furnace reporting—an increase of 265,472 tons, or 16.6 per cent. The iron constituent materials in the aggregate amounted to 31,088,260 tons, an increase of 4,817,764 tons over 1900, or 18.3 per cent.

The increase in fluxing material was 1,033,189 tons, or 14.3 per cent. The consumption of anthracite coal and culm fell off 325,927 tons from 1900, or 36.8 per

cent, and the consumption of bituminous coal and slack shows a slight decrease, while coke presents an increase of 3,343,216 short tons, or 20.4 per cent.

The fuels in the aggregate show an increase of 2,623,771 long tons, or 16 per cent, while the increase in the pig iron tonnage was 15 per cent.

The average consumption of constituent materials (ore, mill cinder, and scrap, not including runner or other scrap produced by the furnace reporting), flux, and fuel in producing a ton of mineral fuel pig iron is shown in the following tabular statement, for 1880, 1890, 1900, and 1905:

Materials consumed per ton of pig iron—mineral fuel.

MATERIAL.	POUNDS.			
	1905	1900	1890	1880
Total	7,800	7,666	7,946	10,156
Ore	4,037	3,921	3,760	4,231
Limestone	1,141	1,147	1,326	2,045
Fuel	2,622	2,598	2,860	3,880
Mill cinder, scrap, etc., purchased, not included in total	258	254	312	227

In the fuel consumption given above the amount used for steam purposes is necessarily included, but the amount so used is not relatively large. Excluding mill cinder and scrap, which, as it was only reported where purchased, does not represent all of that class of material used, the per cent that each class of material is of the total for each census year is as follows:

MATERIAL.	PER CENT OF TOTAL.			
	1905	1900	1890	1880
Total	100.0	100.0	100.0	100.0
Ore	51.8	51.1	47.3	41.7
Limestone	14.6	15.0	16.7	20.1
Fuel	33.6	33.9	36.0	38.2

In comparison with the above the following tabular statement is given, showing the average consumption of ore, flux, and coke per ton of pig iron, by certain large furnaces of a daily capacity of approximately 500 tons or more, in Ohio and Pennsylvania. These furnaces produced over 5,000,000 tons of pig iron in 1905.

MATERIAL.	Pounds.	Per cent of total.
Total	7,087	100.0
Ore	3,874	54.7
Limestone	986	13.9
Coke	2,227	31.4

Products.—Table 33 shows the pig iron product of mineral fuel furnaces for 1880, 1890, 1900, and 1905, classified according to the fuel used. The production of spiegeleisen and ferromanganese and direct castings is included.

TABLE 33.—BLAST FURNACES, MINERAL FUEL—PRODUCTS, BY QUANTITY AND VALUE, CLASSIFIED ACCORDING TO KIND OF FUEL USED: 1880 TO 1905.

KIND.	1905		1900		1890		1880	
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
Aggregate	....	$224,433,959	....	$200,676,934	....	$133,685,378	....	$76,739,573
Total pig iron	16,214,123	221,918,031	14,095,675	200,441,796	8,251,693	133,655,273	2,987,235	75,715,266
Coke and bituminous coal pig iron	14,909,029	203,814,049	12,253,818	173,763,091	6,265,865	100,687,256	1,354,958	35,513,233
Mixed anthracite coal and coke pig iron	1,274,721	17,712,934	1,796,000	26,066,003	1,690,394	28,195,996	638,027	16,627,291
Anthracite coal pig iron	30,373	391,048	45,857	612,702	295,434	4,772,021	994,250	23,574,742
All other products	....	2,515,928	....	235,138	....	30,105	....	1,024,307

Pig iron made with mixed anthracite coal and coke declined 521,279 tons from 1900 to 1905, or 29 per cent. The gain is all in bituminous pig iron, which increased in quantity 2,655,211 tons, or 21.7 per cent, and in value $30,050,958, or 17.3 per cent. The production of pig iron with anthracite coal alone has practically ceased; the last trace of it appears in the small product of 30,373 tons. The quantity of pig iron made with mixed anthracite and coke fuel is a little less than twice the quantity produced in 1880, and bituminous pig iron, chiefly coke, has increased more than tenfold. The amount reported for "all other products," aggregating $2,515,928 in 1905, includes castings made in foundries by blast furnace establishments, granulated slag, slag used for ballast, cement from furnace slag, as well as receipts for custom work and repairing. The last mentioned item was $324,996. Castings produced direct from furnace, as well as spiegeleisen and ferromanganese, are included in the pig iron product.

The average value of coke and bituminous coal pig iron was $13.67 per ton in 1905, $14.18 in 1900, $16.07 in 1890, and $26.21 in 1880; for mixed anthracite and coke pig iron the average price was $13.90 per ton in 1905, $14.51 in 1900, $16.68 in 1890, and $26.06 in 1880; and for pig iron made with anthracite coal alone, $12.87 per ton in 1905, $13.36 in 1900, $16.15 in 1890, and $23.71 in 1880.

Table 34 shows, by states, the production, value, and average value of pig iron for 1880, 1890, 1900, and 1905, and the number of completed furnaces for each of the years.

TABLE 34.—*Blast furnaces, mineral fuel—quantity and value of pig iron, with average value per ton, by states: 1880 to 1905.*

STATE.	Census.	Number of completed furnaces.	Tons.	Value.	Average value per ton.
United States	1905	380	[1] 16,214,123	[1] $221,918,031	$13.69
	1900	325	[2] 14,095,675	[2] 200,441,796	14.22
	1890	419	8,251,693	133,655,273	16.20
	1880	430	[3] 2,987,235	[3] 75,715,266	25.35
Alabama [4]	1900	35	1,153,674	12,645,970	10.96
	1890	34	720,197	8,390,604	11.65
	1880	5	24,296	551,162	22.69
Illinois	1905	21	1,660,610	25,508,271	15.36
	1900	17	1,469,530	15,033,696	10.23
	1890	15	666,676	10,136,960	15.21
	1880	10	85,239	2,391,850	28.06
Missouri [5]	1890	5	60,079	1,191,502	19.83
	1880	8	67,800	1,686,780	24.88
New Jersey	1905	13	262,308	3,600,144	13.72
	1900	11	150,002	2,521,066	16.81
	1890	18	129,500	2,228,724	17.21
	1880	20	140,548	3,410,663	24.27
New York	1905	18	579,420	7,929,654	13.69
	1900	17	327,069	4,856,559	14.85
	1890	28	293,205	4,850,543	16.54
	1880	42	260,616	5,894,405	22.62
Ohio [4]	1900	47	2,552,643	40,155,408	15.73
	1890	60	1,183,030	19,355,162	16.36
	1880	70	442,578	11,525,927	26.04
Pennsylvania	1905	152	7,726,742	107,320,783	13.89
	1900	139	6,774,243	101,435,404	14.97
	1890	206	4,330,470	74,811,310	17.28
	1880	233	1,692,992	43,760,395	25.85
Tennessee [4]	1900	11	318,716	3,856,913	12.10
	1890	12	218,339	2,702,548	12.38
	1880	5	36,963	637,757	17.25
Virginia [4]	1900	21	426,501	6,459,970	15.15
	1890	13	271,831	3,755,651	13.82
	1880	7	7,515	168,120	22.37
West Virginia [5]	1890	5	115,508	2,009,505	17.40
	1880	6	70,298	1,580,096	22.48
Wisconsin [4]	1900	5	182,291	2,369,362	13.00
	1890	4	107,981	1,620,117	15.00
	1880	3	60,306	1,688,548	28.00
All other states	[6] 1905	176	5,985,043	77,559,179	12.96
	[7] 1900	22	741,006	11,107,448	14.99
	[8] 1890	19	154,877	2,602,647	16.80
	[9] 1880	21	98,084	2,419,563	24.67

[1] Includes 9,469 tons of direct castings, valued at $131,700, and 227,648 tons of spiegeleisen and ferromanganese, valued at $6,084,247.
[2] Includes 7,113 tons of direct castings, valued at $87,541, and 215,550 tons of spiegeleisen and ferromanganese, valued at $5,871,955.
[3] Includes 3,508 tons of direct castings, valued at $131,248.
[4] Included in "all other states" in 1905.
[5] Included in "all other states" in 1900 and 1905.
[6] Includes states as follows: Alabama, Colorado, Georgia, Kentucky, Maryland, Michigan, Minnesota, Missouri, Ohio, Tennessee, Virginia, West Virginia, Wisconsin.
[7] Includes states as follows: Colorado, Georgia, Kentucky, Maryland, Minnesota, Missouri, North Carolina, West Virginia.
[8] Includes states as follows: Colorado, Georgia, Indiana, Kentucky, Maryland.
[9] Includes states as follows: Georgia, Indiana, Kentucky, Maryland, Massachusetts.

The highest value per ton of mineral fuel pig iron reported was for Colorado, and the lowest for Georgia. For the states reported in detail the highest value per ton was for Illinois. The values for New York, West Virginia, New Jersey, Ohio, and Pennsylvania conform very closely to the averages for the country at large.

The only states showing an increase in the average value per ton are Alabama, Illinois, and Wisconsin, the apparent increase in the latter two states being large. But attention has already been called to probable error in the 1900 figures for Illinois.

DRY-AIR BLAST.

The most important improvement of late years in the blast furnace industry, and by some claimed not to be equaled by any improvement since Neilson's invention of the hot blast, is the Gayley dry-air blast, installed at the Isabella furnaces of the Carnegie Steel Company.

It had long been suspected that the moisture of the air, varying from day to day, between day and night, and even from hour to hour, was a prime cause of the irregular workings of a blast furnace, and the extent of the part played by moisture is strikingly shown by the comparative tests with dry-air blast and natural blast made at the aforesaid furnaces. The desiccation of the air is effected by passing it through a refrigerating chamber before it goes to the blowing engines and stoves. The furnace takes approximately 40,000 cubic feet of air per minute, and to handle this amount a refrigerating chamber of about 44,000 cubic feet capacity is used, filled with coils of 2-inch pipe, through which circulates the cold brine. This chamber has 90,000 feet of pipe, or over 17 miles. The moisture is deposited on the coils as ice and frost, and is periodically removed, after clearing the coils of the cold brine, by washing them down with a hose. The chamber is divided into four sections, one of which is cleared of ice each day.

When the plant was visited on a clear day in July in 1906, there was being removed 4.59 grains of moisture per cubic foot of air. At the rate of 40,000 cubic feet of air per minute, this is equivalent to 4,534 gallons of water per twenty-four hours, or a little over 18 tons of water, which, if running on natural air, would have gone into the furnace to consume heat energy.

When it is considered that the humidity of the air varies from half a grain per cubic foot on a cold, clear day in winter to 8 or even 9 grains on a muggy day in summer, the fluctuating character of this disturbing element can be readily appreciated.

The economies effected by the use of the dry-air blast are—reduction in fuel consumed per unit of pig iron of some 20 per cent; increase in the capacity of the furnace; reduction in iron ore waste (dust); and control over silicon range.

There is also, incidentally, a saving in power, as the combined power required for the desiccating plant and blowing engine when running on dry-blast is less than that consumed by the blowing engine when running with natural air. This difference is due to the fact that with dry-blast the blowing engine receives its air at 20° temperature and much condensed in volume, and the blast pressure required is less, the furnace being run with 13.5 pounds on dry-blast as against 15 pounds or more with natural air.

The following comparative statement shows the operations of the Isabella furnaces, Nos. 1 and 3, under dry air and natural air:

FURNACE.	Date.	Average daily product (gross tons).	Average amount of coke used per ton of pig iron (pounds).	Number of revolutions of blowing engine per minute.	Average temperature of hot blast (degrees).
No. 1:					
Dry air	November, 1904	447	1,816	96	854
No. 3:					
Natural air	November, 1904	386	2,279	111	750
No. 1:					
Dry air	January 1 to January 10, 1905.	428	1,825	96	869
Natural air	January 15 to January 31, 1905.	414	2,340	111	771
No. 3:					
Dry air	January 15 to January 31, 1905.	432	1,811	96	802
Natural air	January 1 to January 10, 1905.	410	2,351	111	716

This shows for the month of November a saving of 20.3 per cent in coke consumption per ton of pig iron, with an increase of 15.8 per cent in output, through the use of the dry-blast.

In January there is shown a saving of 22 per cent in coke per ton of pig iron, with an increase of 3.4 per cent in output for one furnace, and a saving of 23 per cent in coke and an increase of 5.4 per cent in output for the other furnace, through the use of the dry-blast.

Average gas analyses are given as follows:

	CO (per cent).	CO_2 (per cent).	Temperature (degrees).
Without dry-blast	22.3	13.0	538
With dry-blast	19.9	16.0	376

The reduction of 162 degrees in gas temperature is due to greater concentration of heat in the hearth and the greater weight of burden heated by the gas.

The following is a statement of the normal charge with natural air and with dry-air blast:

CHARGE.	Natural air.	Dry-air blast.
Ore:		
Pounds	20,000	24,000
Per cent of charge	55.9	60.0
Limestone:		
Pounds	5,600	5,800
Per cent of charge	15.6	14.5
Coke:		
Pounds	10,200	10,200
Per cent of charge	28.5	25.5

THE MANUFACTURE OF CHARCOAL PIG IRON.

The leading statistics of the manufacture of charcoal pig iron are shown in Table 35 for the census years 1880, 1890, 1900, and 1905.

TABLE 35.—BLAST FURNACES, CHARCOAL—COMPARATIVE SUMMARY, WITH PER CENT OF INCREASE: 1880 TO 1905.

	CENSUS.				PER CENT OF INCREASE.		
	1905	1900	1890	1880	1900 to 1905	1890 to 1900	1880 to 1890
Number of establishments	33	32	83	116	3.1	[1]61.4	[1]28.4
Capital	[2]$10,664,046	[2]$6,155,839	[2]$17,626,312	$19,268,747	73.2	[1]65.1	[1]8.5
Salaried officials, clerks, etc., number	205	153	[3]259	([4])	34.0	[1]40.9	....
Salaries	$267,370	$173,420	[3]$353,091	([4])	54.2	[1]50.9	....
Wage-earners, average number	2,305	1,623	3,267	16,670	42.0	[1]50.3	[1]80.4
Total wages	$977,034	$562,420	$1,196,008	$4,101,276	73.7	[1]53.0	[1]70.8
Men 16 years and over	2,294	1,617	3,258	([4])	41.9	[1]50.4	....
Wages	$975,533	$561,963	$1,194,573	([4])	73.6	[1]53.0	....
Children under 16 years	11	6	9	([4])	83.3	[1]33.3	....
Wages	$1,501	$457	$1,435	([4])	228.4	[1]68.2	....
Miscellaneous expenses	$395,024	$260,766	$1,011,955	([5])	51.5	[1]74.2	....
Cost of materials used	$5,081,725	$3,250,664	$8,379,150	$7,365,031	56.3	[1]61.2	13.8
Value of products	$7,455,167	$5,344,515	$11,957,775	$12,575,996	39.5	[1]55.3	[1]4.9
Tons of pig iron	414,171	303,567	593,492	388,677	36.4	[1]48.9	52.7

[1] Decrease.
[2] Includes value of rented property—1905, $629,683; 1900, $273,800; 1890, $253,588.
[3] Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905, but not included in this table.
[4] Not reported separately.
[5] Not reported.

The product for 1905 shows an advance over that for 1900, but it is not up to the product of 1890 and is less by 14,408 tons than the average for the years 1880, 1890, and 1900. In 1854 the charcoal pig iron product was 305,623 tons, and it constituted over one-half of the pig iron product of the country, whereas now, after the progress of half a century, it forms less than one-fortieth of the total product.

The capital investment, cost of production as shown by the items reported, and value of products per ton of pig iron for the charcoal industry is shown by the following tabular statement for the years 1890, 1900, and 1905:

	1905	1900	1890
Capital	$25.75	$20.28	$29.70
Expenses	16.23	13.99	18.43
Salaries	0.65	0.57	0.59
Wages paid	2.36	1.85	2.02
Miscellaneous expenses	0.95	0.86	1.70
Cost of materials used	12.27	10.71	14.12
Products	18.00	17.61	20.15

The labor item in 1890 constituted 11 per cent of the total cost per ton; in 1900, 13.2 per cent; and in 1905, 14.5 per cent. In this respect the charcoal pig iron industry differs from the mineral fuel branch, where the item of labor shows a reduction, on account of the general use of large furnaces and improved appliances for charging, machine casting, and for handling material economically.

The same states, 14 in number, that appeared as producers of charcoal pig iron in 1900 were also producers in 1905. Michigan continues to be the heaviest producer. In 1905 all of its charcoal furnaces were active, and the value of products was nearly double that of 1900 and considerably in excess of 1890. Wisconsin, Georgia, New York, and Alabama, in the order named, follow Michigan as producers of charcoal pig iron, though the Michigan charcoal iron product was nearly seven and a half times that of any other state.

Capital.—Table 36 shows the capital investment in all charcoal blast furnace establishments, active and idle, for the census years 1880, 1890, 1900, and 1905.

There has been a decrease of 11 in the number of establishments from 1900 to 1905, though the decrease is not relatively as large as that for the former census periods. The capital investment has increased 27.5 per cent. The active and idle establishments reported, all told, 55 completed charcoal stacks in 1905 of a total daily capacity of 2,540 tons, of which 20, having a capacity of 692 tons, were idle throughout the year.

TABLE 36.—*Blast furnaces, charcoal—active and idle establishments—capital: 1880 to 1905.*

	Census.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, cash, and sundries.
Total	1905	51	[1] $13,293,773	$5,304,501	$7,989,272
	1900	62	[1] 10,429,344	4,454,086	5,975,258
	1890	116	[1] 19,674,167	8,828,233	10,845,934
	1880	212	27,830,547	7,041,659	20,788,888
Active	1905	33	10,664,046	3,680,223	6,983,823
	1900	32	6,155,839	2,159,026	3,996,813
	1890	83	17,626,312	7,437,083	10,189,229
	1880	116	19,268,747	4,663,159	14,605,588
Idle	1905	18	2,629,727	1,624,278	1,005,449
	1900	30	4,273,505	2,295,060	1,978,445
	1890	33	2,047,855	1,391,150	656,705
	1880	[illegible]	8,561,800	2,378,500	6,183,300

[1] Includes value of rented property—1905, $805,683; 1900, $324,500; 1890, $253,588.

Materials used.—Table 37 presents in detail the materials used in the manufacture of charcoal pig iron for each census beginning with 1880.

The consumption of iron ore, all domestic, increased 221,014 tons, or 37 per cent.

The increase in the consumption of charcoal was 11,038,382 bushels, the percentage of increase, 37.7 per cent, corresponding to that of the ore consumption. The consumption of flux, however, as reported shows a very small increase in quantity, less than 1 per cent, and consequently a much reduced consumption per ton of product.

TABLE 37.—BLAST FURNACES, CHARCOAL—MATERIALS USED, BY KIND, QUANTITY, AND COST: 1880 TO 1905.

KIND.	1905		1900		1890		1880	
	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.
Total		$5,245,263		$3,250,064		$8,379,150		$7,365,031
Domestic iron ore	818,761	2,037,258	597,747	1,060,282	1,161,693	3,601,301	836,653	3,515,629
Foreign iron ore	(1)	(1)	(1)	(1)	8,109	37,236	(2)	(2)
Fluxing material	70,896	71,113	70,446	55,298	136,526	158,169	102,381	100,569
Charcoal[3]	[4] 40,309,894	[4] 2,710,754	29,271,512	1,744,892	67,672,156	4,523,320	53,903,228	3,678,658
Mill cinder, scrap, etc	549	2,045	949	3,224	625	2,417	13,979	69,216
All other materials		424,093		386,968		56,707		959

[1] None reported.
[2] Domestic and foreign ores were not reported separately in 1880.
[3] Quantities in bushels.
[4] Includes 2,486,700 bushels of charcoal and its value, the cost of stumpage and labor being reported as expense in other tables.

Products.—Table 38 shows the quantity and value of the charcoal pig iron product for the census years 1880, 1890, 1900, and 1905. No spiegeleisen, ferromanganese, or direct castings were reported as produced with charcoal fuel in 1905.

TABLE 38.—BLAST FURNACES, CHARCOAL—PRODUCTS, BY KIND, QUANTITY, AND VALUE: 1880 TO 1905.

KIND.	1905		1900		1890		1880	
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
Aggregate	....	$7,455,167	....	$5,344,515	....	$11,957,775	....	$12,575,996
Total	[1] 414,171	[1] 7,059,504	[1] 303,567	[1] 5,338,739	593,492	11,957,710	388,677	12,488,744
Charcoal pig iron:								
Hot or warm blast charcoal pig iron	[1] 414,171	[1] 7,059,504	[1] 291,499	[1] 5,061,822	560,594	11,243,119	317,542	10,090,244
Cold-blast charcoal pig iron	(2)	(2)	12,068	276,917	32,898	714,591	71,135	2,398,500
All other products	....	395,663	....	5,776	....	65	....	87,252

[1] Includes product of 1 penal institution.

[2] Not reported separately.

At the census of 1900 and prior censuses a report of the amounts of charcoal pig iron produced with hot or warm blast and with cold-blast, respectively, was called for, but as very little cold-blast charcoal pig iron is now made, this inquiry was dropped in making the canvass for the census of 1905. In 1900 only 4 per cent of the charcoal pig iron was made with cold-blast.

The increase in the quantity of charcoal pig iron product in 1905 over 1900 was 110,604 tons, or 36.4 per cent; and in value, exclusive of all other products, it was $1,720,765, or 32.2 per cent.

Table 39 shows the number of completed furnaces and the quantity, value, and average price per ton of charcoal pig iron for 1880, 1890, 1900, and 1905.

TABLE 39.—*Blast furnaces, charcoal—quantity and value of pig iron, with average value per ton: 1880 to 1905.*

STATE.	Census.	Number of completed furnaces.	Tons.	Value.	Average value per ton.
United States	1905	55	414,171	$7,059,504	$17.04
	1900	66	[1] 303,567	[1] 5,338,739	17.59
	1890	140	593,492	11,957,710	20.15
	1880	251	[2] 388,677	[2] 12,488,744	32.13

[1] Includes 10 tons of direct castings, valued at $121.

[2] Includes 300 tons of direct castings, valued at $14,988.

The average value per ton for charcoal pig iron is $17.04, compared with $17.59 in 1900.

At the census of 1900 the manufacture of pig iron with mixed charcoal and coke fuel was reported by 6 establishments—4 in Tennessee, which used this mixed fuel exclusively; 1 charcoal furnace in Ohio; and 1 coke furnace in Georgia, which made small quantities of pig iron with this fuel.

The manufacture of pig iron with mixed charcoal and coke has now been abandoned, and of the establishments above referred to, 4 made coke pig iron in 1905, 1 made charcoal iron, and 1 was idle.

STEEL WORKS AND ROLLING MILLS.

Table 40 shows the leading statistics for steel works and rolling mills for each census year, 1870 to 1905.

The number of active steel works and rolling mills from which separate reports were received shows a decrease of 23 from the number in 1900. In some cases, however, two or more plants under one and the same ownership and within the same municipality are covered by one report in 1905, and thus figure as one establishment, where in 1900 separate reports were made for the different plants. The number of establishments as here reported means the number of reports received and tabulated.

TABLE 40.—STEEL WORKS AND ROLLING MILLS—COMPARATIVE SUMMARY, WITH PER CENT OF INCREASE: 1870 TO 1905.

	CENSUS.					PER CENT OF INCREASE.			
	1905 [1]	1900	1890	1880	1870 [2]	1900 to 1905	1890 to 1900	1880 to 1890	1870 to 1880
Number of establishments	415	438	395	358	340	[3] 5.3	10.9	10.3	5.3
Capital	[4] $709,130,646	[4] $441,795,983	[4] $278,559,831	$116,458,390	$61,120,015	60.5	58.6	139.2	90.5
Salaried officials, clerks, etc., number	14,330	7,442	[5] 3,242	(6)	(6)	92.6	129.5	......	......
Salaries	$17,860,495	$9,421,868	[5] $4,833,240	(6)	(6)	89.6	94.9	......	......
Wage-earners, average number	207,562	183,023	137,295	96,164	47,099	13.4	33.3	42.8	104.2
Total wages	$122,491,993	$102,238,692	$74,460,433	$41,880,687	$26,843,767	19.8	37.3	77.8	56.0
Men 16 years and over	204,290	180,148	135,134	89,645	45,256	13.4	33.3	50.7	98.1
Wages	$121,615,828	$101,579,174	$74,041,279	(6)	(6)	19.7	37.2	......	......
Women 16 years and over	1,451	1,065	58	33	26	36.2	1,736.2	75.8	26.9
Wages	$441,013	$265,536	$17,106	(6)	(6)	66.1	1,452.3	......	......
Children under 16 years	1,821	1,810	2,103	6,486	1,817	0.6	[3] 13.9	[3] 67.6	257.0
Wages	$435,152	$393,982	$402,048	(6)	(6)	10.4	[3] 2.0	......	......
Miscellaneous expenses	$37,373,831	$24,795,663	$11,817,593	(7)	(7)	50.7	109.8	......	......
Cost of materials used	$441,204,432	$390,568,117	$216,269,022	$130,104,493	$84,342,649	13.0	80.6	66.2	54.3
Value of products	$673,965,026	$596,689,284	$331,860,872	$203,274,042	$129,921,144	13.0	79.8	63.3	56.5
Tons of products	18,216,639	15,040,129	7,388,244	3,046,038	1,331,773	21.1	103.6	142.6	128.7

[1] Exclusive of the statistics of 6 establishments engaged primarily in the manufacture of other products. These establishments made 4,184 tons of steel castings, valued at $347,264.
[2] Includes idle establishments which were not reported separately in 1870.
[3] Decrease.
[4] Includes value of rented property—1905, $8,948,336; 1900, $11,835,940; 1890, $3,212,000.
[5] Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905, but not included in this table.
[6] Not reported separately.
[7] Not reported.

Certain manufacturers in other lines of industry have equipments for the manufacture of steel or rolled material for use in their own establishments in the production of machinery or other constructions. Establishments of this kind reported as partial products in 1905, 4,184 tons of direct steel castings, of a value of $347,264, and these figures must be added to the above table in order to find the total products of steel works and rolling mills. Where a separate report for the steel or rolling mill section of such an establishment was not obtainable, the iron or steel products of this section do not figure in these tables, but enter into the report of the active operations of the establishment, which is classified according to the nature of the finished products. The steel making and rolling mill equipments of such establishments are shown in the tables which give the equipment of all establishments.

Table 41 shows the statistics, by states, of the active establishments which produced steel ingots or castings and hot-rolled iron and steel for 1880, 1890, 1900, and 1905.

TABLE 41.—STEEL WORKS AND ROLLING MILLS—COMPARATIVE SUMMARY, BY STATES: 1880 TO 1905.

STATE.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
				Number.	Salaries.	Average number.	Wages.			
United States	1905	415	[1] $709,130,646	14,330	$17,860,495	207,562	$122,491,993	$37,373,831	$441,204,432	[2] $673,965,026
	1900	438	[1] 441,795,983	7,442	9,421,868	183,023	102,238,692	24,795,663	390,568,117	596,689,284
	1890	395	[1] 278,559,831	[3] 3,242	[3] 4,833,240	137,295	74,460,433	11,817,593	216,269,022	331,860,872
	1880	358	116,458,390	(4)	(4)	96,164	41,880,687	(5)	130,104,493	203,274,042
Alabama	1905	10	9,827,511	165	223,311	3,636	1,508,681	344,837	5,035,190	8,041,566
	1900	6	4,401,295	34	55,548	2,204	1,072,384	107,737	2,451,824	3,904,714
	1890	7	2,208,797	43	56,648	1,696	681,660	157,463	931,460	2,228,536
	1880	1	50,000	......	......	60	18,000	......	25,400	47,500
California	1905	4	1,110,192	35	53,073	773	492,390	84,933	778,970	1,489,012
	1900	3	1,499,162	18	22,250	555	327,184	18,944	506,834	900,854
	1890	4	4,656,611	38	56,549	1,114	693,300	208,088	1,938,333	3,097,155
	1880	1	1,000,000	......	......	319	177,722	......	535,500	780,000
Connecticut	1905	7	8,888,583	137	178,033	2,989	1,586,715	470,393	2,626,931	5,150,675
	1900	7	4,792,902	72	107,775	1,785	939,243	188,313	2,198,682	4,066,836
	1890	8	1,249,429	29	39,537	532	311,771	56,627	911,335	1,463,180
	1880	11	1,385,000	......	......	546	265,210	......	869,758	1,353,787
Delaware	1905	5	6,279,585	91	102,952	1,055	412,003	144,785	939,506	1,597,309
	1900	6	4,207,079	81	132,677	1,490	705,366	140,054	1,635,762	3,159,641
	1890	7	2,558,865	53	78,061	1,637	765,158	43,201	1,549,539	2,608,670
	1880	8	1,341,469	......	......	867	344,476	......	1,214,050	2,347,177
Illinois	1905	23	44,332,095	1,267	1,684,457	16,448	10,070,988	3,382,006	38,649,762	60,021,925
	1900	22	32,672,326	570	631,567	13,632	7,464,442	2,516,516	30,021,296	45,149,498
	1890	19	24,834,645	168	246,193	7,265	4,324,853	577,876	21,951,521	28,872,741
	1880	13	4,845,620	......	......	4,755	2,323,664	......	13,214,536	18,153,439

[1] Includes value of rented property—1905, $8,948,336; 1900, $11,835,940; 1890, $3,212,000.
[2] Exclusive of steel castings to the value of $347,264 made by establishments engaged primarily in the manufacture of other products.
[3] Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905, but not included in this table.
[4] Not reported separately.
[5] Not reported.

TABLE 41.—STEEL WORKS AND ROLLING MILLS—COMPARATIVE SUMMARY, BY STATES: 1880 TO 1905—Continued.

STATE.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
				Number.	Salaries.	Average number.	Wages.			
Indiana	1905	21	$22,985,691	323	$369,962	7,215	$4,071,593	$606,398	$10,905,822	$16,920,326
	1900	27	14,994,210	205	266,764	7,579	4,243,831	376,844	12,438,754	19,338,481
	1890	13	3,888,254	63	95,013	2,581	1,120,779	169,435	2,889,615	4,505,536
	1880	9	1,828,000	...	...	1,740	810,081	...	2,957,467	4,090,868
Kentucky	1905	8	4,716,080	71	78,211	2,149	1,272,114	244,871	4,216,751	6,167,542
	1900	6	3,134,287	73	91,669	1,766	949,047	120,818	3,116,331	5,004,572
	1890	5	1,484,456	32	46,651	1,173	582,007	65,990	1,241,536	2,059,840
	1880	9	2,512,000	...	...	2,205	914,412	...	2,422,389	3,841,377
Maryland	1905	7	4,706,185	117	138,727	1,534	811,128	284,926	6,582,085	8,106,929
	1900	5	2,047,314	40	58,499	1,419	703,445	351,622	4,260,326	5,540,179
	1890	4	1,071,352	16	16,828	557	194,181	20,747	766,849	1,062,204
	1880	5	2,145,000	...	...	1,253	546,974	...	1,829,042	2,550,051
Massachusetts	1905	5	14,348,448	395	364,585	4,544	2,593,235	717,910	6,901,763	11,947,731
	1900	7	13,608,604	93	155,217	6,099	3,401,995	989,570	7,490,732	13,412,379
	1890	14	8,344,394	122	175,664	5,168	2,454,035	169,937	6,786,610	10,981,649
	1880	21	5,526,408	...	...	6,115	2,399,975	...	6,486,372	9,973,911
Michigan	1905	5	1,697,571	38	46,104	1,018	526,565	163,103	1,800,179	2,712,114
	1900	[illegible]	1,904,337	28	30,625	1,459	725,061	146,780	2,365,289	3,574,905
	1890	4	1,437,540	25	44,444	752	435,339	98,096	1,200,758	1,847,565
	1880	2	671,000	...	...	925	360,727	...	1,188,196	1,446,551
Missouri	1905	4	3,672,268	61	88,798	1,349	928,303	172,013	1,588,494	2,999,438
	1900	5	2,195,309	52	81,566	1,604	881,917	72,378	1,605,392	3,200,230
	1890	4	1,612,443	18	28,039	642	393,896	102,786	831,566	1,520,559
	1880	5	3,020,000	...	...	1,789	447,464	...	1,412,934	2,185,513
New Jersey	1905	16	46,380,626	566	804,772	8,334	4,087,977	1,448,560	12.389,675	20,065,972
	1900	16	17,861,970	282	452,357	7,699	3,600,728	1,056,365	14,322,831	21,835,484
	1890	19	8,525,996	129	212,812	4,498	2,301,592	504,967	5,326,401	8,756,431
	1880	18	5,005,550	...	...	3,495	1,412,622	...	3,914,970	6,704,054
New York	1905	20	48,852,865	609	801,337	7,526	4,393,222	1,137,066	13,260,039	21,227,399
	1900	20	9,243,471	191	293,867	4,344	2,410,275	211,984	4,093,932	8,697,995
	1890	19	9,321,793	127	199,862	5,291	2,672,454	486,805	5,932,461	10,310,088
	1880	24	8,702,000	...	...	7,437	2,725,191	...	8,264,186	13,924,622
Ohio	1905	57	87,406,064	1,744	1,931,037	27,756	18,657,542	4,113,201	78,209,770	111,996,673
	1900	64	63,181,422	945	1,250,230	27,638	16,443,825	3,134,600	67,785,834	98,568,619
	1890	55	25,892,390	453	663,638	19,489	11,405,904	1,552,785	28,854,636	45,406,560
	1880	41	9,805,020	...	...	11,127	5,539,913	...	14,848,295	21,880,167
Pennsylvania	1905	186	363,233,842	8,129	10,057,776	110,904	65,306,427	21,924,663	237,875,025	363,773,577
	1900	209	247,001,768	4,450	5,390,828	94,664	53,817,488	14,573,593	218,860,649	332,588,174
	1890	186	166,691,801	1,738	2,564,584	76,609	42,356,589	7,072,834	122,530,544	188,714,190
	1880	158	60,489,929	...	...	43,832	20,099,576	...	61,564,150	98,445,709
Tennessee[1]	1900	3	129,570	15	14,986	216	100,375	12,158	235,573	387,409
	1890	4	927,549	21	30,830	460	218,699	91,295	492,789	881,404
	1880	5	1,401,000	...	...	1,350	376,786	...	859,965	1,369,400
Virginia	1905	3	2,122,686	37	66,806	1,022	381,715	110,426	821,788	1,515,959
	1900	4	1,913,944	34	61,905	1,503	452,020	87,915	1,124,356	1,836,670
	1890	6	2,174,787	40	65,701	1,742	639,347	100,471	1,584,285	2,400,603
	1880	5	838,000	...	...	1,134	352,539	...	1,199,698	1,986,416
West Virginia	1905	12	8,716,170	107	142,342	4,409	2,813,319	492,683	8,742,471	13,454,802
	1900	8	7,122,357	81	108,426	3,975	2,066,289	166,378	8,729,280	13,394,911
	1890	8	5,012,842	[illegible]	86,687	3,346	1,552,589	88,289	6,402,189	8,547,360
	1880	8	2,390,191	...	...	3,228	1,301,658	...	2,326,014	4,422,936
Wisconsin[2]	1905	10	3,588,494	133	155,870	1,915	1,124,529	277,330	4,501,159	7,379,038
	1900	7	4,026,564	65	73,624	1,370	909,117	252,093	3,394,932	6,004,989
	1880	1	700,000	...	...	1,300	647,577	...	1,729,274	3,284,556
All other states	[3] 1905	12	26,265,690	305	572,342	2,986	1,453,547	1,253,727	5,379,052	9,397,039
	[4] 1900	10	5,858,092	113	141,488	2,022	1,024,660	271,001	3,929,508	6,122,744
	[5] 1890	9	6,665,887	64	125,499	2,743	1,356,280	249,901	4,146,595	6,596,601
	[6] 1880	13	2,802,203	...	...	2,687	816,120	...	3,242,297	4,486,008

[1] Included in "all other states" in 1905.
[2] Included in "all other states" in 1890.
[3] Includes establishments distributed as follows: Colorado, 1; Georgia, 1; Kansas, 1; Maine, 1; Oregon, 1; Rhode Island, 4; Tennessee, 2; Washington, 1.
[4] Includes establishments distributed as follows: Colorado, 2; Kansas, 1; Maine, 1; Minnesota, 2; Oregon, 1; Rhode Island, 1; Washington, 1; Wyoming, 1.
[5] Includes establishments distributed as follows: Colorado, 1; Georgia, 1; Iowa, 1; Maine, 1; Minnesota, 1; New Hampshire, 1; Rhode Island, 1; Wisconsin, 1; Wyoming, 1.
[6] Includes establishments distributed as follows: Colorado, 1; District of Columbia, 1; Georgia, 1; Kansas, 2; Maine, 2; Nebraska, 1; New Hampshire, 2; Rhode Island, 1; Vermont, 1; Wyoming, 1.

There were 26 states reporting in 1905, compared with 27 states in 1900 and 1890, and 29 in 1880. Minnesota has 2 establishments, of which 1 was idle in 1905 and the other produced steel castings which were consumed by the establishment in manufactures. The rolling mill in Wyoming was idle in 1905. Georgia has resumed the manufacture of rolled iron and steel products. There were 27 states, all told, making steel and rolling mill products, including Minnesota, which manufactured a small amount of steel in an establishment otherwise classified.

Pennsylvania continues to produce more than one-half of the cast steel and rolled iron and steel products, its output in 1905 constituting 54 per cent of the total value, compared with 55.7 per cent in 1900, with 56.9 per cent in 1890, and with 48.4 per cent in 1880. This

state reports over one-half of the capital and one-half of all employees and expenses pertaining to the industry. Its present share of the steel making and rolling mill industry is even greater than its share of the blast furnace branch, and exceeds by over $30,000,000 the total product of steel works and rolling mills for the entire country in 1890.

Ohio ranks second, with an increase of 13.6 per cent; Illinois third, with an increase of 32.9 per cent, and New York fourth, with an increase of 144 per cent. A decrease in the value of products, compared with 1900, appears in Delaware, Indiana, Massachusetts, Michigan, Missouri, New Jersey, and Virginia.

CAPITAL.

The capital invested in steel works and rolling mill establishments, active and idle, for 1880 to 1905, is shown in Table 42.

TABLE 42.—*Steel works and rolling mills—active and idle establishments—capital: 1880 to 1905.*

	Census.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, cash, and sundries.
Total	1905	494	[1] $730,378,292	$417,216,418	$313,161,874
	1900	476	[1] 449,926,470	214,025,431	235,901,039
	1890	429	[1] 284,271,524	132,989,177	151,282,347
	1880	391	120,522,745	71,567,596	48,955,149
Active	1905	415	709,130,646	400,038,881	309,091,765
	1900	438	441,795,983	208,249,924	233,546,059
	1890	395	278,559,831	128,623,160	149,936,671
	1880	358	116,458,390	69,033,147	47,425,243
Idle	1905	79	21,247,646	17,177,537	4,070,109
	1900	38	8,130,487	5,775,507	2,354,980
	1890	34	5,711,693	4,366,017	1,345,676
	1880	33	4,064,355	2,534,449	1,529,906

[1] Includes value of rented property—1905, $9,027,956; 1900, $11,888,815; 1890, $3,230,000.

The capital invested in steel works and rolling mills constitutes 73.6 per cent of that employed in the iron and steel industries; substantially the same proportion as in 1900, when it represented 73.9 per cent of the aggregate capital.

The increase in the total capital invested in steel works and rolling mills from 1900 to 1905 was $280,451,822, or 62.3 per cent, as compared with the increase for the decade from 1890 to 1900 of $165,654,946, or 58.3 per cent. Of the aggregate capital reported in 1905, 97.1 per cent was invested in active establishments and 2.9 per cent in idle, as compared with an investment of 98.2 per cent of the total capital in 1900 in active establishments, and 1.8 per cent in idle. Of the total capital in 1905, 57.1 per cent was in buildings, machinery, tools, and implements and 42.9 per cent in lands, cash, and sundries; compared with 47.6 per cent in the former and 52.4 per cent in the latter in 1900. The increase of investment in equipment is thus shown to have been relatively much greater than the investment in land and active capital.

The idle establishments, 79 in number, were located in the following states: Alabama, 2; Delaware, 1; Illinois, 2; Indiana, 13; Kentucky, 1; Massachusetts, 2; Minnesota, 1; Missouri, 1; New Jersey, 2; New York, 5; Ohio, 10; Pennsylvania, 33; Virginia, 1; West Virginia, 1; Wisconsin, 3; and Wyoming, 1. The capital invested in idle establishments shows an increase of $13,117,159 over that in 1900.

The 7 forges and bloomeries, 6 active and 1 idle, which are included with the steel works and rolling mills, but are not equipped with hot rolls, are all that is left of a once large industry. They have a reported capital of $256,639, of which $70,681 is for buildings, machinery, tools, and implements, and $185,958 for land, cash, and sundries.

MATERIALS USED.

Table 43 shows the quantity and cost of the principal materials used by steel works and rolling mills in 1880, 1890, 1900, and 1905, and the percentage of increase, both in tonnage and value.

The statistics for 1900 showed a decline in the use of iron ore by rolling mills, due chiefly to the dismantling of puddling furnaces, but the returns for 1905 show an increase which a little more than makes up this decrease. The consumption of pig iron, spiegeleisen, and ferromanganese has increased 1,780,947 tons; old iron or steel rails and other scrap iron and steel, 1,010,990 tons; purchased hammered iron-ore blooms, pig or scrap blooms, and imported Swedish billets and bars, 49,249 tons; purchased muck bar or scrap bar, 44,622 tons; purchased iron or steel ingots, blooms, billets, tin-plate bars, sheet bars, or slabs, 949,850 tons; and purchased wire rods, 25,189 tons.

At the census of 1900 the total amount and kind of fuel consumed was reported, but no separation was made between fuel used for power and that used for melting and heating purposes. In making the canvass for the present census an inquiry was made of the cost of fuel used for power. As the character of the fuel reported as used for power purposes does not appear in the returns, the total amount of fuel by kinds can not be given, and hence no comparison can be made between 1905 and 1900 of the consumption of fuel by kinds, but only of the cost of all fuel used. This shows an increase since 1900 of $12,850,571, or 57.5 per cent.

Table 43.—STEEL WORKS AND ROLLING MILLS—MATERIALS USED, BY KIND, QUANTITY, AND COST, WITH PER CENT OF INCREASE: 1880 TO 1905.

KIND.	CENSUS. 1905 Tons.	1905 Cost.	1900 Tons.	1900 Cost.	1890 Tons.	1890 Cost.	1880 Tons.	1880 Cost.	PER CENT OF INCREASE. 1900 to 1905 Tons.	1900 to 1905 Cost.	1890 to 1900 Tons.	1890 to 1900 Cost.	1880 to 1890 Tons.	1880 to 1890 Cost.
Aggregate	....	$441,204,432	....	$390,568,117	....	$216,269,022	....	$130,104,493	......	13.0	......	80.6	......	66.2
Iron ore	549,995	2,396,792	340,028	1,326,395	519,199	3,355,139	333,405	2,779,879	61.7	80.7	[1]34.5	[1]60.5	55.7	20.7
Pig iron, spiegeleisen, ferromanganese, and all other pig iron	12,191,228	172,101,436	10,410,281	151,042,348	5,846,906	105,346,851	2,361,304	61,868,776	17.1	13.9	78.0	43.4	147.6	70.3
Old iron or steel rails, and other scrap iron and steel	5,124,277	67,601,248	4,113,287	66,670,855	1,726,162	36,101,038	1,198,842	37,692,774	24.6	1.4	138.3	84.7	44.0	[1]4.2
Purchased hammered iron-ore blooms, pig or scrap blooms, and imported Swedish billets and bars	81,969	1,781,126	32,720	1,150,575	49,867	2,329,138	92,261	5,993,145	150.5	54.8	[1]34.4	[1]50.6	[1]46.0	[1]61.1
Purchased muck or scrap bar	205,951	5,066,732	161,329	4,535,939	209,534	6,252,594	47,995	2,369,544	27.7	11.7	[1]23.0	[1]27.5	336.6	163.9
Purchased iron or steel ingots, blooms, billets, tin-plate bars, sheet bars or slabs—except imported Swedish billets and bars	4,632,257	103,420,970	3,682,407	92,123,412	874,518	28,753 506	68,882	4,339,057	25.8	12.3	321.1	220.4	1,169.6	562.7
Purchased wire rods	161,914	4,774,383	136,725	5,419,617	(2)	(2)	(2)	(2)	18.4	[1]11.9	......	......	......	......
Fuel, total cost	....	35,192,961	....	22,342,390	....	17,397,434	....	13,202,597	......	57.5	......	28.4	......	31.8
Anthracite coal and culm	231,125	792,262	944,018	1,220,694	858,071	1,487,713	631,229	1,875,062	......	......	10.0	[1]17.9	35.9	[1]20.7
Bituminous coal and slack	7,055,093	14,367,934	10,944,046	14,679,804	4,617,055	9,663,208	4,112,222	10,510,255	......	......	137.0	51.9	12.3	[1]8.1
Coke	[3]638,776	2,009,392	[3]926,516	2,014,390	[3]393,051	1,311,588	[3]142,605	582,901	......	......	135.7	53.6	175.6	125.0
Charcoal	[4]3,133,533	299,138	[4]2,250,022	170,345	[4]2,770,611	243,773	[4]2,667,902	234,379	......	......	[1]18.8	[1]30.1	3.8	4.0
Natural gas used as fuel	....	4,382,667	....	3,098,409	....	3,566,946	....	....	......	41.4	......	[1]13.1	......	......
Oil used as fuel	[5]633,813	908,154	[5]1,302,615	1,158,748	[5]1,859,138	1,124,206	....	....	......	......	[1]29.9	3.1	......	......
Fuel used for power	....	12,433,414	....	(2)	....	(2)	....	....	......	......	......	......	......	......
All other materials	....	48,868,784	....	45,956,586	....	16,733,322	....	1,858,721	......	6.3	......	174.6	......	800.3

[1] Decrease. [2] Not reported separately. [3] Short tons. [4] Bushels. [5] Barrels.

The use of oil as fuel in 1905 by steel works and rolling mills, in whole or in part, was reported by 16 states. Illinois was the largest user. Natural gas was used in 5 states, and by 109 establishments, distributed as follows: Pennsylvania, 69; Ohio, 22; Indiana, 9; West Virginia, 8; and Kentucky, 1. The cost of natural gas used as fuel in 1905 shows an increase of $1,284,258, or 41.4 per cent. In 1900 natural gas was used by 92 establishments and in 1890 by 85. The establishments using natural gas show an increase of 8 in Pennsylvania, 14 in Ohio, 3 in West Virginia, and a decrease of 8 in Indiana. The cost of natural gas consumed in Pennsylvania in 1905 shows an increase of $773,737, or 29.7 per cent, over 1900; in Ohio it shows an increase of $523,943, or 407.8 per cent; in West Virginia, an increase of $124,914, or 165 per cent; and in Kentucky, an increase of $20,949, or 611.1 per cent; while in Indiana the decrease is $159,285, or 56.3 per cent.

PRODUCTS.

Table 44 shows the quantity and value of the leading products reported by the steel works and rolling mills for 1880, 1890, 1900, and 1905.

Table 44.—STEEL WORKS AND ROLLING MILLS—PRODUCTS, BY KIND, QUANTITY, AND VALUE: 1880 TO 1905.

KIND.	1905 Tons.	1905 Value.	1900 Tons.	1900 Value.	1890 Tons.	1890 Value.	1880 Tons.	1880 Value.
Total	....	$673,965,026	....	$596,689.284	....	$331,860,872	....	$203,274,042
Rails:[1]								
Iron	900	20,700	880	31,180	13,715	622,224	416,890	20,978,697
Steel	2,193,705	58.236,050	2,250,457	46,501,979	1,853,862	60,272,575	670,161	37,892,075
Bessemer	2,065,024	54,627,488	(2)	(2)	1,853,862	60,272,575	662,032	37,408,625
Open-hearth	128,681	3,608,562	(2)	(2)	(3)	(3)	8,129	483,450
Splice bars, including all patent splices and rail joints	174,055	5,663,052	(2)	(2)	(2)	(2)	(2)	(2)
Iron and steel bars and rods, not including sheet or tin-plate bars or wire rods	2,442,810	84,069,122	2,493,159	100,597,221	1,572,347	68,567,415	874,144	56,696,679
Iron and steel wire rods	1,792,704	52,995,031	916,587	35,529,529	(2)	(2)	(2)	(2)
Structural shapes:								
Iron	4,475	145,200	27,091	1,051.556	122,792	6,941,474	86,438	5,520,719
Bessemer steel	331,671	11,089,170	263,800	8,381,717	85,440	4,529,411	497	63,060
Open-hearth steel	618,391	21,496,531	566,092	19,928,249	68,123	3,992,074	71	8,800
Iron and steel hoops, bands, and cotton ties	337,223	12,760,010	[4]1,195,189	[4]49,159,747	[5]546,203	[5]23,628,849	[5]201,039	[5]13,979,893
Iron and steel skelp	1,557,690	46,780,202						
Iron and steel rolled car axles	631	26,138	2,229	88,841	2,232	127,500	2,348	179,154
Iron and steel hammered car axles	82,954	2,849,691	100,377	4,394,096	52,184	2,935,451	19,539	1,600,104
Iron and steel muck and scrap bar produced for sale	150,926	3,940,998	203,681	5,940,587	252,089	7,411,748	57,562	2,440,941
Iron and steel boiler and other plates and sheets, except nail and tack plate, black plates or sheets for tinning, and armor plate	1,856,469	77,802,001	1,488,066	68,109,223	652,693	39,359,094	262,063	22,432,202

[1] Rails renewed or rerolled included under "all other products."
[2] Not reported separately.
[3] None reported.
[4] Includes skelp.
[5] Hoops and skelp only.

TABLE 44.—STEEL WORKS AND ROLLING MILLS—PRODUCTS, BY KIND, QUANTITY, AND VALUE: 1880 TO 1905—Cont'd.

KIND.	1905		1900		1890		1880	
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
Iron and steel nail plate	67,857	1,826,756	81,101	2,466,340	(1)	(1)	(1)	(1)
Iron and steel tack plate	18,744	635,320	16,563	650,218	(1)	(1)	(1)	(1)
Black plates or sheets for tinning:								
Iron	64,111	2,809,936	(2)	(2)	(1)	(1)	(1)	(1)
Bessemer steel	353,027	18,271,625	355,077	18,673,312	(1)	(1)	(1)	(1)
Open-hearth steel	86,887	4,215,518	38,937	2,294,494	(1)	(1)	(1)	(1)
Iron and steel armor plate and gun forgings	22,839	9,560,816	15,302	7,526,479	(1)	(1)	(1)	(1)
Iron and steel rolled blooms, slabs, billets, tin-plate bars, and sheet bars produced for sale	4,823,585	109,611,104	4,172,286	96,321,887	(1)	(1)	(1)	(1)
Steel ingots produced for sale	196,404	3,985,310	103,707	2,781,145	(1)	(1)	(1)	(1)
Direct steel castings	[3] 287,325	[3] 20,600,136	177,156	14,609,893	(1)	(1)	(1)	(1)
All other products	....	124,574,609	....	111,651,591	....	113,473,057	....	41,481,718

[1] Not reported separately.
[2] None reported.
[3] Exclusive of 4,184 tons of steel castings, valued at $347,264, made by establishments engaged primarily in the manufacture of other products.

The above table gives the chief products comparable for the different census years. The products shown in detail aggregate 17,291,328 tons at the census of 1905, as compared with 14,467,737 tons for 1900. The total classified product of steel works and rolling mills in 1905 was 18,216,639 tons, as shown by Table 45, compared with 15,040,129 tons in 1900 (an increase of 21.1 per cent), and with 7,388,244 tons in 1890 and 3,046,038 tons in 1880.

Table 45 is a detailed summary of the products for 1905.

TABLE 45.—*Steel works and rolling mills—detailed summary of products: 1905.*

KIND.	Tons.	Value.
Products, aggregate value	....	$673,965,026
Rolled, forged, and other classified products, total	18,216,639	584,299,439
Direct steel castings, total	[1] 287,325	[1] 20,600,136
Bessemer steel castings, including steel castings made in Clapp-Griffiths, Robert-Bessemer, and other converters	13,653	1,597,944
Open-hearth steel castings	269,561	18,560,238
Acid	182,330	12,964,150
Basic	87,231	5,596,088
Crucible and other kinds of steel castings	4,111	441,954
Rolled iron and steel—		
Rails, total	2,194,605	58,256,750
Iron	900	20,700
Steel	2,193,705	58,236,050
Bessemer steel	2,065,024	54,627,488
Open-hearth steel	128,681	3,608,562
Renewed or rerolled rails	99,530	2,480,328
Splice bars, including all patent splices and rail joints	174,055	5,663,052
Iron and steel bars and rods, not including sheet or tin-plate bars or wire rods	2,442,810	84,069,122
Iron and steel wire rods	1,792,704	52,995,031
Structural shapes, including light and heavy shapes, total	954,537	32,730,901
Iron	4,475	145,200
Steel	950,062	32,585,701
Bessemer steel	331,671	11,089,170
Open-hearth steel	618,391	21,496,531
Iron and steel hoops, bands, and cotton ties	337,223	12,760,010
Iron and steel skelp	1,557,690	46,780,202
Iron and steel car axles	83,585	2,875,829
Muck and scrap bar, produced for sale	150,926	3,940,998
Iron and steel boiler and other plates and sheets, except nail and tack plate, black plates for tinning, and armor plate	1,856,469	77,802,001
Iron and steel nail plate	67,857	1,826,756
Iron and steel tack plate	18,744	635 320
Black plates or sheets for tinning, total	504,025	25,297,079
Iron	64,111	2,809,936
Steel	439,914	22,487,143
Bessemer steel	353,027	18,271,625
Open-hearth steel	86,887	4,215,518
Iron and steel armor plate and gun forgings	22,839	9,560,816
Iron and steel rolled blooms, slabs, billets, tin-plate bars, and sheet bars, produced for sale	4,823,585	109,611,104
All other rolled iron and steel products	377,665	16,743,727
Steel ingots, produced for sale	196,404	3,985,310
All other forged, cast, or other iron and steel products, not including cut nails, wire nails, bolts, nuts, rivets, spikes, washers, etc	274,061	15,684,967

[1] Exclusive of 4,184 tons of steel castings, valued at $347,264, made by establishments engaged primarily in the manufacture of other products.

TABLE 45.—*Steel works and rolling mills—detailed summary of products: 1905*—Continued.

KIND.	Tons.	Value.
Products—Continued.		
Iron and steel scrap sold	877,177	$11,079,831
Amount received for custom work and repairing	....	58,137,817
Miscellaneous products, not rolled, total	....	20,447,939
Gray iron and malleable castings, including cast-iron pipe	[1] 46,644	2,569,792
Ordnance	1,594	988,804
Machinery, etc	....	1,269,675
Copper rods	[1] 1,406	463,057
Copper wire	[1] 25,966	7,252,917
Total value of all other than iron or steel products, including amount received for custom work and repairing	....	7,903,694
Steel ingots, manufactured for consumption or sale, total	13,379,083	240,284,576
Bessemer steel ingots, including steel ingots made in Clapp-Griffiths, Robert-Bessemer, Bookwalter, or other converters	7,754,488	132,951,636
Open-hearth steel ingots	5,548,396	101,762,469
Acid	573,475	12,967,630
Basic	4,974,921	88,794,839
Crucible steel ingots	76,199	5,570,471
Miscellaneous products, not rolled, value previously included, total	....	137,971,340
Cut nails and cut spikes, total	[2] 1,311,549	2,394,108
Iron	[2] 206,615	400,846
Steel	[2] 960,670	1,732,064
Combined iron and steel	[2] 144,264	261,198
Iron and steel wire nails	[2] 9,061,512	17,495,362
Iron and steel wire	[1] 624,298	30,992,672
Other wire products	[1] 339,121	19,063,409
Iron and steel bolts, nuts, rivets, forged spikes, washers, etc	[3] 621,165,317	13,854,635
Iron and steel wrought pipe or tubes	849,047	43,985,728
Iron and steel seamless-drawn, clinched, brazed, etc., pipe or tubes	[3] 46,224,320	2,290,234
Iron and steel springs, car, carriage, furniture, and all other	22,022	1,708,632
Horse and mule shoes	68,594	5,483,137
Stamped ware	....	292,923
Shovels, spades, scoops, etc	....	410,500

[1] Short tons [2] Kegs of 100 pounds. [3] Pounds.

Iron and steel rails.—The total production of iron and steel rails was 2,194,605 tons, as compared with 2,251,337 tons in 1900, a slight decrease in tonnage. This does not include rails renewed or rerolled. Bessemer steel rails amounted to 2,065,024 tons and open-hearth steel rails to 128,681 tons. In 1900 the open-hearth steel rails made did not exceed 1,500 tons and in 1890 no open-hearth steel rails were made.

The average value of steel rails, as obtained from these reports, was $26.55 per ton in 1905, $20.66 per ton in 1900, $32.51 per ton in 1890, and $56.54 per ton in 1880. It should be stated that the Census report of

1900 was for the fiscal year ending June 30, 1900, or the business year of the establishment nearest conforming thereto. During the year 1899 there was a very wide fluctuation in prices for Bessemer steel rails, the average monthly prices, as reported by the American Iron and Steel Association, ranging from $18.50 per ton in January, 1899, to $35 per ton in December, and resulting in an average for the year of $28.12. The values as reported by the different producers in 1900 show a like wide range, from less than $18 per ton for Illinois to nearly $30 per ton for Ohio, and result in a low average for the country at large. Since the early part of 1901 the quoted price for steel rails at the mills, as reported by the American Iron and Steel Association, has been uniform at $28 per ton.

In 1905 steel rails were produced by 14 establishments. Bessemer steel rails were made by 12 establishments and open-hearth steel rails by 5.

In addition there were 8 establishments which did not manufacture new rails, but which renewed or rerolled rails, making 22 establishments in the aggregate that rolled rails. Two of the establishments that manufactured rails also rerolled or renewed rails. The total amount renewed or rerolled was 104,429 tons, of which 99,530 tons were reported as of a value of $2,480,328 and 4,899 tons were rerolled on toll.

Pennsylvania produced 812,691 tons of rolled rails, chiefly Bessemer, a little less than three-eighths of the entire product; in 1900 its production was over one-half of the total. Illinois ranks second, its production being all Bessemer. New York is third and Maryland fourth, with Bessemer steel rails in each case; Alabama, not a producer of steel rails in 1900, is fifth, its rail product being of open-hearth steel; and Ohio sixth, with all Bessemer steel rails. Only 900 tons of iron rails were reported.

Splice bars.—Splice bars, including all patent splices and rail joints, to the extent of 174,055 tons were reported at the census of 1905, of an average value of $32.54 per ton. In 1900 these products were not specifically reported but were included under miscellaneous rolled products, and their value was included in that for "all other products." Pennsylvania made more than one-half of this class of products, 93,043 tons, and Illinois, with 54,978 tons, was the second largest producer.

Bars and rods.—The production of iron and steel bars and rods, not including wire rods, shows a slight decrease in quantity from 1900, namely, 2 per cent, and a decrease of 16.4 per cent in value. The average value in 1905 was $34.41 per ton; in 1900 it was $40.35 per ton; in 1890, $43.61 per ton; and in 1880, $64.86 per ton. In the figures given for 1890 and 1880 only the quantity and value of bars and rods manufactured for sale were given. In 1900 and for the present census the quantity and value are given of all bars and rods made, whether sold as products or consumed by the establishment in the manufacture of other products. The increased value given to bars and rods when manufactured into bolts, nuts, etc., by the rolling mill establishment has been included under "all other products."

The average value shows a decline of 14.7 per cent from the average for 1900. This is in harmony with the general decline in the average value per ton of all classified products of steel works and rolling mills, which fell from $33.94 in 1900 to $32.08 in 1905, or 5.5 per cent. Products in this group were made in all states having rolling mills except Georgia, Kansas, and West Virginia. Of the leading states, Pennsylvania made 1,166,234 tons, nearly one-half of the total amount, of an average value of $34.66 per ton; Ohio, Indiana, and Illinois produced, respectively, 274,191 tons, 212,421 tons, and 145,527 tons; the average value per ton in these states, in the order named, being $31.63, $31.62, and $32.52.

Wire rods.—Wire rods show the heaviest increase of any of the groups of products, the increase in tonnage being 876,172 tons, or 95.6 per cent, and in value, $17,465,502, or 49.2 per cent. The average value in 1905 was $29.96 per ton, and in 1900, $38.76.

The manufacture of wire rods is reported by 11 states—Pennsylvania, Ohio, Illinois, Massachusetts, Indiana, Kentucky, Colorado, New York, New Jersey, Alabama, and Rhode Island. Of the leading states, Pennsylvania turned out 596,892 tons, of an average value of $28.36 per ton. With two exceptions the output of the other states was in each state the product of less than 3 establishments.

Structural shapes.—Structural shapes in the aggregate have increased from 856,983 tons in 1900 to 954,537 tons in 1905, or 11.4 per cent. The average value for all shapes has remained substantially the same, $34.26 per ton in 1900 and $34.29 per ton in 1905. Iron shapes in 1905 averaged $32.45 per ton; Bessemer steel, $33.43 per ton; and open-hearth steel, $34.76 per ton. Iron shapes were reported from California and Pennsylvania. Bessemer steel structural shapes were reported for Pennsylvania, Illinois, Ohio, and Wisconsin, in the order named as to quantity of product, and open-hearth steel shapes from Pennsylvania, New Jersey, Indiana, Wisconsin, New York, Colorado, Ohio, and Alabama. Pennsylvania produced more than six-tenths of the total quantity of steel structural shapes, or 822,618 tons, of which 546,440 tons were open-hearth steel; New Jersey was the next largest producer, followed by Illinois, and then by Ohio.

Iron and steel hoops, bands, cotton ties, and skelp.—The production of hoops, bands, cotton ties, and skelp in 1905 amounted to 1,894,913 tons, of a value of $59,540,212, an increase from 1900 of 699,724 tons, or 58.5 per cent, in quantity and of $10,380,465, or 21.1 per cent, in value. The production of skelp, the chief item of this group, amounted in 1905 to 1,557,690

tons, and hoops, bands, and cotton ties to 337,223 tons. In 1900 the production of skelp was not reported separately. The average value of all products of this group in 1905 was $31.42 per ton, compared with $41.13 per ton for 1900. The average value for skelp in 1905 was $30.03 per ton.

Hoops, bands, and cotton ties were reported in 1905 from Pennsylvania, Ohio, Illinois, Georgia, Massachusetts, and Alabama; Pennsylvania produced 200,461 tons; Ohio, 102,823 tons; and the other 4 states, the remaining 33,939 tons. Skelp was produced by Pennsylvania to the extent of 1,058,588 tons, or two-thirds of the product of the country. Ohio made 211,624 tons; West Virginia, 192,644 tons; and Illinois, Connecticut, and New York produced the remaining 94,834 tons.

Car axles.—In 1905 only 631 tons of rolled car axles were reported, whereas in 1900 the production amounted to 2,229 tons.[1] Iron and steel hammered car axles were reported from Pennsylvania, Michigan, Illinois, California, and Ohio in 1905 to the extent of 82,954 tons, of an average value of $34.35 per ton. In 1900, 100,377 tons of hammered car axles, of an average value of $43.78 per ton, were manufactured by Pennsylvania, Missouri, Michigan, Virginia, Alabama, New Jersey, and Delaware. Pennsylvania produced 88.5 per cent of the hammered car axles in 1905, compared with 78.9 per cent in 1900.

Muck and scrap bar produced for sale.—The muck and scrap bar shown in the table does not include that made and consumed by the producing establishments in the manufacture of more highly finished rolled products. Muck or scrap bar, to be marketed as such, was reported from Pennsylvania, Ohio, Indiana, and Delaware to the extent of 150,926 tons; more than two-thirds of this was from Pennsylvania, and one-fifth from Ohio. The average value of the product was $26.11 per ton at the census of 1905, and in 1900 it was $29.16 per ton.

Boiler and other plates and sheets, except nail and tack plates, black plates or sheets for tinning, and armor plate.—The production of iron and steel boiler and other plates, exclusive of nail and tack plates, black plates or sheets for tinning, and armor plate (which are reported separately), was reported by 13 states and shows an increase of 368,403 tons, or 24.8 per cent, in quantity and of $9,692,778, or 14.2 per cent, in value. The average value per ton was $41.91 at the census of 1905, $45.77 in 1900, $60.30 in 1890, and $85.60 in 1880. The bulk of the output was reported by Pennsylvania, which manufactured 1,297,086 tons, over two-thirds of the total, at an average value of $40.43 per ton; and from Ohio, which made 364,790 tons, one-fifth of the total, at an average value of $43.94 per ton. Other producing states were Illinois, the product being by less than three establishments; West Virginia, with 34,036 tons; Kentucky, 33,921 tons; Indiana, 23,947 tons; and in a lesser degree, Delaware, Missouri, Alabama, Connecticut, New York, New Jersey, and Maryland.

Nail and tack plate.—Nail plate was reported in 1905 by 10 states to the extent of 67,857 tons, of an average value of $26.92 per ton, compared with 81,101 tons in 1900, of an average value of $30.41 per ton. This shows a decrease in quantity of 16.3 per cent. More than one-half of the amount, namely, 37,162 tons, of an average value of $25.42 per ton, was made in Pennsylvania. West Virginia was the next in rank. Other states making nail plate were Colorado, Kentucky, Illinois, Ohio, Massachusetts, Indiana, California, and Virginia, named in the order of amount of product.

Tack plates were reported by 4 states—West Virginia, Massachusetts, Pennsylvania, and California. The average value for the 18,744 tons made was $33.89, compared with an average value of $39.26 for the 16,563 tons made in 1900. The increase in quantity was 13.2 per cent.

Black plates or sheets for tinning.—Prior to the stimulus given the tin and terne plate industry in this country by the tariff act of 1890, very few black plates or sheets for tinning were produced. In 1900 the total production as reported was 394,014 tons, of a value of $20,967,806, an average value of $53.22 per ton. At the census of 1905 the total amount was 504,025 tons, of a value of $25,297,079, an average of $50.19 per ton. This is an increase of 27.9 per cent in quantity over 1900, and of 20.6 per cent in total value of product. In 1900 there were 44 active black plate establishments. No iron black plates were reported by any of the establishments. The Bessemer black plates, constituting more than nine-tenths of the total production, averaged in 1900, $52.59 per ton and the open-hearth black plates, $58.93 per ton.

At the present census returns were made of black plates by 35 active establishments. Iron black plates were made by 6 establishments, Bessemer steel black plates by 25 establishments, and open-hearth steel black plates by 17 establishments.

Bessemer steel black plates show a slight decrease in quantity, while open-hearth steel black plates have more than doubled. The average value in 1905 for iron black plates was $43.83 per ton; for Bessemer steel, $51.76; and for open-hearth steel, $48.52—or for all grades, as before stated, $50.19 per ton.

The value per ton for open-hearth steel plates appears considerably less than for Bessemer steel, owing to the low valuation given in certain reports. The 12 establishments in Pennsylvania and Ohio producing open-hearth steel black plates, which made nearly one-half of the total product, show an average value per ton of $52.64. Pennsylvania,

[1] Error in Twelfth Census report consisting of the tabulation as "rolled car axles" of 1,592 tons of hammered car axles, of a value of $98,861, in New Jersey, and 52,518 tons of hammered car axles, of a value of $2,569,349, in Pennsylvania, has been corrected.

with 34,665 tons of iron black plates, more than one-half of the total amount, ranked first; it was followed by Ohio and West Virginia. Pennsylvania was also first in the production of Bessemer steel black plates, making 213,904 tons, nearly two-thirds of the total, followed by Indiana, Ohio, West Virginia, and Kentucky. In the manufacture of open-hearth steel black plates Illinois was first, followed by Ohio, Pennsylvania, Maryland, West Virginia, and Indiana.

Armor plate and gun forgings.—The product reported under armor plate and gun forgings is from 4 establishments—3 in Pennsylvania and 1 in New Jersey—a relatively small amount of gun forgings being reported. There is shown an increase in the total products of this group of 7,537 tons, or 49.3 per cent, in quantity and of $2,034,337, or 27 per cent, in value. The product in 1905 was of an average value per ton of $418.62, as compared with an average value per ton in 1900 of $491.86.

Rolled blooms, slabs, billets, tin-plate bars, and sheet bars produced for sale.—Much the larger part of this group appears again in the material of other rolling mills. The figures are comparable with those of 1900 only, as prior thereto the products of this group were not reported separately. The products show an increase of 651,299 tons in quantity, or 15.6 per cent, over those of 1900, and an increase of 13.8 per cent in value. At the census of 1905 the average value per ton was $22.72 and in 1900 it was $23.09.

The manufacture of these products for sale was reported by 12 states. Pennsylvania produced 2,582,848 tons, valued at $22.54 per ton, more than one-half of the total amount, and Ohio, 1,803,873 tons, valued at $22.37 per ton. Illinois reported 298,805 tons, and the remaining 138,059 tons were from Alabama, Kentucky, Indiana, Maryland, Connecticut, Colorado, Massachusetts, Rhode Island, and Delaware, the last 4 states marketing very small amounts.

Steel ingots produced for sale.—The total production of steel ingots was 13,379,083 tons, valued at $240,284,576. This is the total quantity of steel ingots made both for consumption by the producing establishments and for sale. Of this quantity, 196,404 tons, or less than 1.5 per cent, were produced for sale, the average value thereof being $20.29 per ton, as compared with an average value of $26.82 per ton in 1900. Much the larger part of the steel ingots sold becomes material for rolling mills purchasing steel ingots, though some of the ingots go to establishments manufacturing heavy forgings.

Of the ingots produced for sale, West Virginia and Pennsylvania reported all but 3 per cent. The production of steel ingots will be considered at length in subsequent tables.

Direct steel castings.—Direct steel castings to the amount of 287,325 tons and valued at $20,600,136, or an average value of $71.70 per ton, were reported in 1905. This is an increase of 62.2 per cent over the quantity reported in 1900, which was 177,156 tons, valued at $14,609,893, or an average of $82.47 per ton. Pennsylvania, with 26 establishments, produced 114,411 tons of direct steel castings, valued at $8,041,419, or an average of $70.29 per ton; Illinois, with 7 establishments, 56,038 tons, valued at $4,148,259, or an average of $74.03 per ton; New York, with 5 establishments, 35,605 tons, valued at $1,991,778, or an average of $55.94 per ton; Ohio, with 8 establishments, 35,156 tons, valued at $2,308,178, or an average of $65.66 per ton; New Jersey, with 4 establishments, 11,656 tons, valued at $1,406,317, or an average of $120.65 per ton; Wisconsin, with 8 establishments, 9,215 tons, valued at $848,230, or an average of $92.05 per ton; and Indiana, with 3 establishments, 8,709 tons, valued at $498,447, or an average of $57.23 per ton. Direct steel castings to the extent of 790 tons, not included in the above, were reported by 1 establishment in Indiana, classified as "foundry and machine shop products." The remaining 16,535 tons, valued at $1,357,508, were produced by 12 establishments distributed through the states of Missouri, Michigan, Connecticut, Alabama, Delaware, Tennessee, California, Colorado, and Rhode Island, named in the order of their production.

Direct steel castings are further shown in later tables.

Miscellaneous rolled products.—In 1905, 377,665 tons of miscellaneous rolled products were reported, comprising locomotive and car wheel tires, rolled blanks suitable for drawing into seamless tubes, flats, socket iron and steel, etc. The value of these was $16,743,727, an average per ton of $44.33. Pennsylvania produced 253,330 tons of these miscellaneous products; New York, 47,445 tons; Ohio, 33,825 tons; and New Jersey, 12,514 tons. Other material producers were Michigan, Connecticut, Kentucky, and California. No other state produced over 600 tons.

Miscellaneous forged, cast, or other iron and steel products.—The total production of forged, cast, or other miscellaneous iron and steel products, not otherwise specifically classified, amounted to 274,061 tons, of a value of $15,684,967, an average of $57.23 per ton. Included therein are light and heavy forgings, and miscellaneous iron and steel products, not rolled, and the product of the few remaining forges and bloomeries. The latter amounted to 5,626 tons, valued at $157,505, an average of $28 per ton.

Total production of steel castings and of rolled and forged iron and steel, by states.—Table 46 shows the total production by steel works and rolling mills of all kinds of rolled and forged iron and steel, including steel ingots produced for sale and direct steel castings, in 1880, 1890, 1900, and 1905, by states.

TABLE 46.—STEEL WORKS AND ROLLING MILLS—QUANTITY OF CLASSIFIED PRODUCTS, WITH PER CENT OF TOTAL, BY STATES: 1880 TO 1905.

STATE.	QUANTITY (TONS).				PER CENT OF TOTAL.			
	1905	1900	1890	1880	1905	1900	1890	1880
United States	18,216,639	15,040,129	7,388,244	3,046,038	100.0	100.0	100.0	100.0
Alabama	265,202	100,318	46,612	580	1.5	0.7	0.6	(1)
California	31,045	25,419	50,667	12,500	0.2	0.2	0.7	0.4
Colorado	148,747	119,972	18,646	4,018	0.8	0.8	0.3	0.1
Connecticut	93,181	43,908	24,756	17,216	0.5	0.3	0.3	0.6
Delaware	31,851	53,025	52,176	30,284	0.2	0.4	0.7	1.0
District of Columbia				236				(1)
Georgia	9,566	......	2,534	10,269	0.1	......	(1)	0.3
Illinois	1,657,885	1,485,346	813,079	287,946	9.1	9.9	11.0	9.5
Indiana	446,458	425,946	98,394	69,536	2.5	2.8	1.3	2.3
Iowa	......	......	1,056	......	......	......	(1)	......
Kansas	(2)	(2)	......	17,013	......	......	......	0.6
Kentucky	169,466	129,309	43,823	58,610	0.9	0.9	0.6	1.9
Maine	2,567	2,750	9,196	7,903	(1)	(1)	0.1	0.3
Maryland	315,566	223,306	18,055	42,508	1.7	1.5	0.3	1.4
Massachusetts	143,833	137,502	134,483	117,620	0.8	0.9	1.8	3.9
Michigan	55,154	80,483	36,239	20,652	0.3	0.5	0.5	0.7
Minnesota	......	13,259	2,290	......	......	0.1	(1)	......
Missouri	70,254	59,026	24,739	23,846	0.4	0.4	0.3	0.8
Nebraska	......	......	......	1,786	......	......	......	(1)
New Hampshire	......	......	5,938	7,123	......	......	0.1	0.2
New Jersey	161,431	142,152	140,425	73,765	0.9	0.9	1.9	2.4
New York	569,323	137,981	214,310	226,084	3.1	0.9	2.9	7.4
Ohio	3,533,426	2,737,497	1,007,154	340,562	19.4	18.2	13.6	11.2
Oregon	18,000	4,505	......	......	0.1	(1)	......	......
Pennsylvania	9,825,753	8,503,852	4,259,800	1,483,736	53.9	56.5	57.7	48.7
Rhode Island	25,961	5,618	11,613	7,262	0.1	(1)	0.2	0.2
Tennessee	19,206	13,400	18,438	25,112	0.1	0.1	0.3	0.8
Vermont	......	......	......	5,357	......	......	......	0.2
Virginia	33,588	40,943	46,823	31,407	0.2	0.3	0.6	1.0
Washington	5,760	5,000	......	......	(1)	(1)	......	......
West Virginia	384,932	352,814	231,998	60,212	2.1	2.4	3.2	2.0
Wisconsin	198,484	187,376	66,692	54,154	1.1	1.2	0.9	1.8
Wyoming	......	9,422	8,308	8,741	......	0.1	0.1	0.3

[1] Less than one-tenth of 1 per cent.
[2] The single rolling mill in this state was active in 1905 and 1900, but was engaged exclusively on custom work.

The production of steel works and rolling mills in 1905 shows an increase of 3,176,510 gross tons, or 21.1 per cent over the production of 1900, an average of 4.2 per cent per year; compared with an increase of 7,651,885 tons in 1900 over 1890, an average of 10.4 per cent per year, and with an increase of 4,342,206 tons in 1890 over 1880, an average of 14.3 per cent per year. Pennsylvania made more than one-half of the total production in 1905, 1900, and 1890, and nearly one-half in 1880. The maximum percentage of the total products was in 1890 and has since gradually decreased. Ohio made nearly one-fifth of the production in 1905, and its proportion of the total has shown a steady increase.

The states of Delaware, Maine, Michigan, and Virginia show a reduction in output for 1905 compared with 1900, and Minnesota and Wyoming, which were producers in 1900, had no production in 1905. Kansas does not appear as a producer in 1905 and 1900. Its single rolling mill was in operation in both years, but was employed on custom work and repairing. The heaviest relative growth was in New York and Alabama, the products of the former showing for 1905 an increase of 312.6 per cent over 1900, and of the latter state, an increase of 164.4 per cent.

MISCELLANEOUS SECONDARY PRODUCTS.

The production of cut nails and spikes, wire, wire nails, bolts, nuts, rivets, forged spikes, washers, wrought pipes or tubes, horse and mule shoes, springs, etc., when made by steel works or rolling mills, represents the manufacture into more highly finished forms of nail plate, wire rods, bars, skelp, or other rolling mill products already reported. The added value due to this higher finishing has been carried to "all other products," as before stated, the quantities and value of the nail plate, wire rods, skelp, etc., so used, being reported under their respective groups as rolling mill products.

Table 47 shows, for 1905, the quantity and value of the leading products of this group manufactured by rolling mills and the value of those manufactured by other establishments, together with the number of establishments producing each kind.

Nails.—There was reported in 1905 by rolling mills 1,311,549 kegs of cut nails and cut spikes, of a value of $2,394,108, an average value of $1.83 per keg, and 9,061,512 kegs of wire nails, of a value of $17,495,362, an average value of $1.93 per keg. Altogether 34 rolling mills reported the manufacture of nails, 17 of which made cut nails and spikes and 21, wire nails. The total nail product of rolling mills, 10,373,061 kegs, was valued at $19,889,470, an average value of $1.92 per keg.

The manufacture of iron and steel nails and spikes, cut and wrought, including wire nails, was reported by 83 establishments not equipped with hot rolls, the

value of their products amounting to $12,940,726. The total value of all iron and steel nails and spikes, cut and wrought, including wire nails, was $32,830,196. This was the output of 117 establishments.

The production of nails by establishments other than rolling mills comprises the product of 76 establishments, classified as "iron and steel, nails and spikes, cut and wrought, including wire nails, not made in rolling mills or steel works," amounting to $8,922,896, and the wire nail product of 7 establishments, classified as "wire," which made wire nails of the value of $4,017,830, or a total value of $12,940,726.

Table 47.—STEEL WORKS AND ROLLING MILLS—PRINCIPAL IRON AND STEEL MISCELLANEOUS SECONDARY PRODUCTS OF ROLLING MILLS AND ESTABLISHMENTS OTHER THAN ROLLING MILLS: 1905.

KIND.	TOTAL.		ROLLING MILLS.			ESTABLISHMENTS OTHER THAN ROLLING MILLS.	
	Number of establishments.	Value.	Number of establishments.	Quantity.	Value.	Number of establishments.	Value.
Nails and spikes, total	117	$32,830,196	34	[1]10,373,061	$19,889,470	83	$12,940,726
Cut nails and cut spikes			17	[1]1,311,549	2,394,108		(2)
Iron			8	[1]206,615	400,846		(2)
Steel			16	[1]960,670	1,732,064		(2)
Combined iron and steel			11	[1]144,264	261,198		(2)
Wire nails			21	[1]9,061,512	17,495,362		(2)
Iron and steel wire and wire products of wire-drawing mills, not including wire nails, total	41	65,858,594	25	[3]963,419	50,056,081	16	15,802,513
Wire			25	[3]624,298	30,992,672		(2)
Other wire products			12	[3]339,121	19,063,409		(2)
Iron and steel bolts, nuts, rivets, forged spikes, washers, etc	118	28,138,607	30	[4]277,306	13,854,635	88	14,283,972
Iron and steel wrought pipe or tubes	27	59,527,178	14	[4]849,047	43,985,728	13	15,541,450
Iron and steel seamless-drawn, clinched, brazed, etc., pipe or tubes	23	4,149,696	8	[4]20,636	2,290,234	15	1,859,462
Horse and mule shoes	19	6,282,118	11	[4]68,594	5,483,137	8	798,981
Iron and steel springs, car, carriage, furniture, etc	61	7,449,468	9	[4]22,022	1,708,632	52	5,740,836

[1] Kegs. [2] Not reported separately. [3] Short tons. [4] Tons.

The products of the establishments included in the industry classified as "iron and steel, nails and spikes, cut and wrought, including wire nails, not made in rolling mills or steel works" were in detail as follows:

Total	$8,922,896
Wire nails	2,787,159
Horse nails	2,345,762
Tacks and small nails	1,664,161
Shoe tacks and shoe nails	988,144
Cut nails	218,056
Spikes, etc	72,285
Miscellaneous products	847,329

The value of the wire nails made by these establishments ($2,787,159), combined with that of the wire nail products of the classified "wire" industry ($4,017,830), makes a total of $6,804,989 as the value of the wire nails made by establishments other than rolling mills, and this combined with the wire nail product of the rolling mills gives a total of $24,300,351 as the value of all iron and steel wire nails. The total production of cut nails and spikes, not including tacks and small nails, amounted to $2,684,449.

The quantity made by establishments other than rolling mills was not reported, but estimated on the basis of $1.83 per keg for cut nails and spikes and $1.93 per keg for wire nails—the average values for rolling mills—the cut and wire nail product of these establishments (not including wrought nails, tacks, and small nails) would be 3,684,557 kegs. The total product was thus approximately 14,057,000 kegs.

The total nail product by kinds, so far as it can be itemized, is as follows:

KIND.	Quantity (kegs).	Value.
Total		$32,830,196
Wire nails	12,587,000	24,300,351
Cut nails and cut spikes	1,470,000	2,684,449
Horse nails		2,345,762
Tacks and small nails		1,664,161
Shoe tacks and shoe nails		988,144
Miscellaneous products		847,329

Rolling mill establishments making cut and wire nails were distributed as follows: Pennsylvania, 13; Illinois, 3; Indiana, Massachusetts, Ohio, and West Virginia, 2 each; and Alabama, California, Colorado, Connecticut, Kentucky, New York, Rhode Island, Virginia, 1 each. The other establishments making these are distributed as follows: Massachusetts, 37 (including 1 wire-drawing mill); Pennsylvania, 8; New York, 7; Illinois, 10 (including 4 wire-drawing mills); Ohio, 5; Connecticut, 4; Wisconsin, 3; Indiana, 4 (including 2 wire-drawing mills); Maryland, 2; and New Hampshire, Rhode Island, and West Virginia, 1 each.

In 1900, 4,603,010 kegs of iron and steel wire nails were reported as the product of 11 establishments which rolled rods and drew wire, as compared with 9,061,512 kegs by 21 establishments in 1905. This is an increase of 90.9 per cent in number of establishments and of 96.9 per cent in quantity of product.

The decline in the cut nail industry, which started in 1886, has continued. In 1900 cut nails were manufactured by 23 rolling mill establishments to the amount of 1,689,143 kegs, whereas in 1905 there were 17 producing establishments, with a product of

1,311,549 kegs, a decrease of 26.1 per cent in number of establishments and 22.4 per cent in output.

Wire.—In 1905 there were 25 rolling mill establishments making wire rods, which drew iron and steel wire, of which establishments 12 manufactured therefrom wire products, principally fencing and netting. The wire, reported as such, amounted to 624,298 short tons, valued at $30,992,672, an average price of $49.64 per short ton, and the wire products to 339,121 short tons, valued at $19,063,409, or $56.21 per short ton. The two combined give an iron and steel wire production, not including wire nails, of 963,419 short tons, valued at $50,056,081. If the weight of the 9,061,512 kegs of wire nails is added thereto, 1,416,495 short tons is obtained as the total quantity of iron and steel wire and wire products of all kinds made by rolling mills. The combined value of these products was $67,551,443.

In 1900 the iron and steel wire product reported by rolling mills and steel works (not including wire nails) was 579,595 gross tons, valued at $35,283,688, or an average value of $60.88 per gross ton, which is equivalent to 649,146 short tons, of an average value of $54.35 per ton.

In addition to the wire products of the rolling mills, iron and steel wire was drawn from purchased wire rods in 1905 by 16 establishments in the industry classified as "wire." The value of the iron and steel wire products of these establishments was $17,362,395, distributed as follows:

Total	$17,362,395
Wire, as such	5,148,731
Barb wire	3,851,136
Wire nails	4,017,830
Field fencing	2,914,802
Poultry netting	505,797
Hay and bale ties	248,277
Other wire products	675,822

There occurs in the above a duplication of $1,559,882 on account of wire purchased, after deducting which $15,802,513 remains as the value of the wire and wire products made by wire drawing mills from purchased wire rods.

The quantity of the wire and wire products produced by wire drawing establishments does not appear, but on the basis of an average value of $50 per ton, approximately that of the rolling mill products, the product of the wire drawing establishments, other than rolling mills, would appear to be approximately 316,000 short tons, which, added to the wire products of the rolling mills, 1,416,494 short tons, gives an approximate total of 1,732,000 short tons of wire products, of a value of $83,353,956, as the output of all establishments.

In addition to the above, wire nails, valued at $2,787,159, were made by establishments in the industry classified as "iron and steel, nails and spikes, cut and wrought, including wire nails, not made in rolling mills or steel works." Some of these nails were made from purchased wire, and some from purchased wire rods drawn by the establishments. As the amount of wire drawn by these establishments can not be determined, it is not included in the above statement.

The following tabular statement shows the production of the wire industry as a whole for 1900 and 1905:

Wire manufactured—comparative summary: 1905 and 1900.

	1905	1900	Per cent of increase.
Aggregate value	$83,353,956	$52,871,387	57.7
Rolling mills:			
Total wire and wire products—			
Short tons	1,416,494	879,296	61.1
Value	$67,551,443	$47,728,784	41.5
Total wire and wire products, not including wire nails—			
Short tons	963,419	649,146	48.4
Value	$50,056,081	$35,283,688	41.9
Iron and steel wire—			
Short tons	624,298		
Value	$30,992,672		
Iron and steel wire products, not including wire nails—			
Short tons	339,121		
Value	$19,063,409		
Wire nails—			
Short tons	453,075	230,150	96.9
Value	$17,495,362	$12,445,096	40.6
Establishments in "wire" industry:			
Total iron and steel wire and wire products, made from purchased wire rods	$15,802,513	$5,142,603	207.3

The rolling mills producing wire and wire products in 1905 were distributed as follows: 8 in Pennsylvania, 3 in New Jersey, 2 each in Illinois, Indiana, New York, and Ohio; and 1 each in Alabama, Colorado, Connecticut, Kentucky, Massachusetts, and Rhode Island. Of the establishments otherwise classified which draw iron and steel wire from purchased wire rods in 1905, 4 were in Illinois, 4 in Massachusetts, 3 in Pennsylvania, 2 in Indiana, 2 in New Jersey, and 1 in New York.

The state of Pennsylvania produced 189,121 short tons of wire, valued at $7,847,348, and 149,102 short tons of "other wire products," valued at $6,562,460, or 35.1 per cent of the wire and wire products, not including wire nails manufactured by rolling mills; Ohio, Illinois, and Massachusetts were the next in rank as producers. Nearly 80 per cent of the iron and steel wire and wire products of mills which used purchased wire rods, was from the state of Illinois, and if the wire industry is considered as a whole, without regard to whether mills roll their rods or purchase them, this state easily ranks second.

Bolts, nuts, rivets, forged spikes, washers, etc.—The manufacture of bolts, nuts, rivets, forged spikes, washers, etc., was reported by 30 rolling mill establishments in 1905, to the extent of 277,306 tons, valued at $13,854,635, or at an average value of $49.96 per ton. Products of this class, valued at $14,283,972, were made by 88 establishments other than rolling

mills. On the basis of the average price per ton of the manufactures of the rolling mills ($49.96) an estimate of 285,908 tons is obtained as the quantity of this product. The total quantity for all bolts, nuts, rivets, forged spikes, etc., was on this basis over 560,000 tons.

The rolling mills reporting these products comprised 10 in Pennsylvania, 3 each in Illinois and Virginia, 2 each in California and Ohio, and 1 each in Colorado, Connecticut, Delaware, Indiana, Kentucky, Massachusetts, Missouri, New Jersey, New York, and Wisconsin. Pennsylvania reported more than one-half and Illinois nearly one-fifth of those produced by rolling mills.

Wrought pipe.—The manufacture of wrought pipe or tubes was reported by 14 rolling mill establishments, of which 9 were in Pennsylvania, 2 in Ohio, and 1 each in Illinois, New York, and West Virginia. The production, 849,047 tons, valued at $43,985,728, averaged in value $51.81 per ton. In addition wrought pipe of the value of $15,541,450 was produced by 13 establishments which purchased skelp. These 13 establishments appear in the industry classified as "iron and steel pipe, wrought," the total value of the products of which are $17,400,912, consisting of the wrought pipe product made from purchased skelp, just referred to, and seamless drawn, clinched, brazed, riveted, and other pipe or tubes, valued at $1,859,462. On the basis of the average value per ton of wrought pipe shown by the rolling mill product, the wrought pipe made from purchased skelp by establishments other than rolling mills represents in quantity nearly 300,000 tons, and makes with the rolling mill product a total of approximately 1,150,000 tons, valued at $59,527,178.

Seamless-drawn, clinched, brazed, etc., pipe or tubes.—Eight rolling mill establishments located in Pennsylvania, Ohio, and Michigan reported the manufacture of 20,636 tons of seamless drawn, clinched, brazed, etc., pipe or tubes of a value of $2,290,234, or an average of $110.98 per ton. In the industry classified as "iron and steel pipe, wrought," there were reported by 15 establishments products of a like character aggregating $1,859,462, making a total of $4,149,696.

Horse and mule shoes.—The manufacture of horse and mule shoes was reported by 11 rolling mill establishments and by 8 establishments otherwise classified. Of the former, 2 each were located in New York, Pennsylvania, and Virginia, and 1 each in Delaware, Illinois, New Jersey, Rhode Island, and Wisconsin. The product of the rolling mills aggregated 68,594 tons, valued at $5,483,137, or $79.94 per gross ton. Of the establishments other than rolling mills, which manufacture horse and mule shoes, 3 were located in Pennsylvania, and 1 each in Connecticut, Massachusetts, Minnesota, New Jersey, and New York. The product of the establishments, not rolling mills, is of a value of $798,981; and estimated on the basis of the value reported for the rolling mill horse and mule shoe product, it is equivalent to about 10,000 tons. This combined with the rolling mill product gives a total product of 78,594 tons. The New York rolling mill establishments produced the largest amount of horse and mule shoes, and Pennsylvania ranked second. These 2 states produced more than one-half of the rolling mill product.

Springs.—Car, carriage, furniture, and other springs were made by 9 steel works and rolling mill establishments to the amount of 22,022 tons, valued at $1,708,632, an average value of $77.59 per ton. Of these steel works and rolling mills, 2 each were located in Michigan and Pennsylvania, and 1 each in California, Connecticut, Illinois, Massachusetts, and New Jersey.

The greater part of the iron and steel springs for cars, carriages, etc., was made by establishments otherwise classified. Of the latter, there were 52, reporting products valued at $5,740,836. Less than 23 per cent of this class of products was from establishments which made or rolled their own steel.

The other miscellaneous iron and steel products specifically reported by steel works and rolling mills will be found in Table 45. It is not possible to show the total product of cast iron pipe or gray iron and malleable castings, as the greater part of the same is included in the reports of establishments classified under "foundry and machine shop products," and can not be segregated.

The manufacture of 1,594 tons of ordnance, valued at $988,804, was reported by steel works and rolling mills, and products valued at $557,903 by establishments classified as "ordnance and ordnance stores," making a total value of $1,546,707.

The rolling mill establishments reported stamped ware valued at $292,923, which should be combined with the product of establishments making stamped ware as a specialty. They reported machinery manufactured to the extent of $1,269,675, which is a by-product for "foundry and machine shop products," and shovels, spades, scoops, etc., valued at $410,500, a by-product for "tools, not elsewhere specified."

The manufacture of copper rods was reported by 3 establishments classified as steel works and rolling mills, which were located in Illinois, Massachusetts, and Pennsylvania; and copper wire by 3 establishments located in Illinois, Massachusetts, and New Jersey.

EQUIPMENT.

Table 48 shows the equipment and capacity of the steel works and rolling mills in 1905, as compared with 1900, 1890, and 1880.

TABLE 48.—*Steel works and rolling mills—active and idle establishments—number, equipment, and capacity: 1880 to 1905.*

	1905	1900	1890	1880
Steel works and rolling mills:				
Number of establishments	[1] 518	476	429	391
Total daily capacity, finished, rolled, and forged products, tons, double turn	[1] 115,210	90,122	41,576	19,730
Bessemer establishments, included above	49	42	51	11
Bessemer converters—				
Number	103	91	97	24
Total daily capacity, tons of ingots, double turn	45,427	38,420	19,285	3,988
Open-hearth steel establishments, included above	126	96	58	25
Open-hearth furnaces—				
Number	515	331	129	37
Total daily capacity, tons of ingots, double turn	35,457	19,030	3,608	738
Acid furnaces—				
Number	159	152	(2)	(2)
Daily capacity, tons of ingots, double turn	7,750	6,419	(2)	(2)
Basic furnaces—				
Number	356	179	(2)	(2)
Daily capacity, tons of ingots, double turn	27,707	12,611	(2)	(2)
Crucible steel establishments, included above	49	40	47	37
Crucible pots which can be used at a heat	2,939	2,619	2,606	2,691

[1] Exclusive of forges and bloomeries but including 31 establishments other than steel works and rolling mills. (See Table 13.)
[2] Not reported.

This comprises both active and idle establishments and includes those otherwise classified. The number of establishments shows an increase of 42, or 8.8 per cent, and their daily capacity of finished rolled and forged products, an increase of 25,088 tons, or 27.8 per cent. Establishments having Bessemer converters have increased 7 in number and 12 in number of converters, while the open-hearth steel establishments have gained 30 in number and 184 in number of furnaces, 7 of the latter being acid furnaces and 177 basic. Crucible establishments have increased slightly in number and considerably in equipment. Equipment for the production of steel by other or miscellaneous processes was reported by 6 establishments, including 1 establishment otherwise classified. Of the total number of active and idle establishments classified under steel works and rolling mills, 93 were equipped both for the production of steel and for the manufacture of hot rolled iron and steel products; 74, for the production of steel ingots and castings only; and 320, for the production of hot rolled iron and steel products only. There were thus 167 establishments equipped for steel production and 413 for the manufacture of hot rolled iron and steel products.

Of the total number of establishments in 1900, 42 were equipped for the manufacture of Bessemer steel, with 91 converters; 96, for the manufacture of open-hearth steel, with 331 furnaces; 40, for the manufacture of crucible steel, with 2,619 pots; and 11, for the manufacture of steel by miscellaneous processes. There were in 1900, 425 establishments equipped for the manufacture of hot rolled iron and steel products, while 51 were not so equipped. In 1890, 299 produced rolled iron and steel, but not steel ingots or castings, and 130 were equipped for the production of steel.

STEEL PRODUCTION.

The following tables present, by states, the production of steel ingots and direct steel castings reported at the census of 1905 and former census years.

Table 49 shows the total production of all kinds of steel ingots and castings, by states, 1880 to 1905.

TABLE 49.—STEEL WORKS—QUANTITY OF STEEL INGOTS AND DIRECT STEEL CASTINGS, BY STATES: 1880 TO 1905.

STATE.	TOTAL (TONS).				BESSEMER STEEL (TONS).			
	1905	1900	1890	1880	1905	1900	1890	1880
United States	[1] 13,670,592	10,685,000	4,174,652	1,027,381	7,768,915	7,532,028	3,617,198	879,650
Alabama	227,899	48,191	268	...	1,177	...	...	...
California	579	(2)	7,550	...	...	(2)	...	...
Colorado	188,828	129,306	16,029	...	103,625	129,306	16,029	...
Connecticut [3]	47,307	2,197	1,556	1,964	...	...	...	...
Delaware	868	...	...	...	868	...	...	...
Illinois	1,555,198	1,460,710	779,956	227,293	1,193,548	1,211,115	777,478	226,352
Indiana	81,589	51,967	1,116	...	...	...	...	...
Kentucky	89,610	74,737	...	312	89,610	74,737	...	...
Maryland	309,481	255,070	893	...	302,481	251,320	...	...
Massachusetts	109,025	51,552	26,272	8,585	...	...	14,065	...
Michigan	2,500	4,575	4,855	...	2,500	2,300	3,214	...
Minnesota	147	10,392	...	...	147	50	...	...
Missouri	7,131	9,600	...	7,508	...	...	...	7,508
New Hampshire	...	...	3,304	4,037	...	...	...	...
New Jersey	68,288	62,832	21,149	10,663	4,177	...	...	...
New York	474,258	23,232	101,769	77,451	363,063	...	94,109	75,143
Ohio	2,529,997	1,812,829	395,574	96,324	2,049,153	1,697,353	340,266	73,938
Oregon	231	...	...	...	231	...	...	...
Pennsylvania	7,733,640	6,431,297	2,652,920	586,994	3,442,312	3,911,127	2,210,730	496,709
Rhode Island	20,120	...	...	...	300	...	...	...
Tennessee	606	146	134	3,571	...	...	...	...
Vermont	...	...	...	2,679	...	...	...	...
West Virginia	214,075	254,070	161,307	...	214,075	254,070	161,307	...
Wisconsin	9,215	2,297	...	...	1,648	650	...	...

[1] Includes 4,184 tons of steel castings made by establishments engaged primarily in the manufacture of other products.
[2] California produced a small quantity of Tropenas steel castings in 1900, which was included in the statistics for the iron and steel shipbuilding industry.
[3] Connecticut produced a small quantity of Tropenas steel castings in 1900, but this production is not included in the figures given for this state.

TABLE 49.—STEEL WORKS—QUANTITY OF STEEL INGOTS AND DIRECT STEEL CASTINGS, BY STATES: 1880 TO 1905—Continued.

STATE.	OPEN-HEARTH STEEL (TONS).				CRUCIBLE STEEL (TONS).				MISCELLANEOUS STEEL (TONS).			
	1905	1900	1890	1880	1905	1900	1890	1880	1905	1900	1890	1880
United States	5,820,397	3,044,356	480,035	75,269	80,059	104,393	73,882	68,037	1,221	4,223	3,537	4,425
Alabama	226,722	48,191	268									
California	579		7,550									
Colorado	85,203											
Connecticut	46,507	802			800	1,395	1,556	1,889				75
Delaware												
Illinois	361,650	249,313	2,081	825		282	397	116				
Indiana	80,799	51,953	893			14	223		790			
Kentucky				245				67				
Maryland	7,000	2,250				1,500	893					
Massachusetts	105,047	51,552	11,732	8,460	3,978		475	125				
Michigan		2,275					1,641					
Minnesota		10,342										
Missouri	7,131	9,600										
New Hampshire			3,304	4,037								
New Jersey	57,606	49,912	13,887	402	6,505	9,600	6,637	9,368		3,320	625	893
New York	104,898	14,371	1,161		6,297	8,861	6,499	2,308				
Ohio	480,844	114,926	55,308	22,064		550		322				
Oregon												
Pennsylvania	4,230,657	2,437,918	383,851	32,986	60,240	81,349	55,427	53,842	431	903	2,912	3,457
Rhode Island	19,820											
Tennessee		94		3,571	606	52	134					
Vermont				2,679								
West Virginia												
Wisconsin	5,934	857			1,633	790						

The growth of steel production has been the heaviest of any portion of the iron and steel industry. The increase in the steel production in 1905 was 2,985,592 tons over that of 1900, or 27.9 per cent. This is an average increase of nearly 600,000 tons per year. The product for 1900 shows a gain over that of 1890 of 6,510,348 tons, or 155.9 per cent, an average increase of about 650,000 tons per year; and the product of 1890 shows a gain over that of 1880 of 3,147,271 tons, or 306.3 per cent, an average increase of nearly 315,000 tons per year.

The following tabular statement shows the proportion of the total that Bessemer steel, open-hearth steel, and crucible and miscellaneous steels, respectively, formed for the several census years:

KIND.	PER CENT OF TOTAL STEEL PRODUCTION.			
	1905	1900	1890	1880
Total	100.0	100.0	100.0	100.0
Bessemer steel	56.8	70.5	86.6	85.6
Open-hearth steel	42.6	28.5	11.5	7.3
Acid	5.5	8.3		
Basic	37.1	20.2		
Crucible and miscellaneous steel	0.6	1.0	1.9	7.1

When compared with other branches of the iron and steel industry, the growth is particularly noticeable. The increase in the steel tonnage for the last five years, as above noted, was 27.9 per cent; whereas the increase in the tonnage of pig iron was 15.1 per cent, and of all rolling mill products, 21.1 per cent.

The increase in Bessemer steel since 1900 has been relatively small—236,887 tons, or 3.1 per cent; whereas open-hearth steel has increased 2,776,041 tons, or 91.2 per cent. For the decade from 1890 to 1900, Bessemer steel increased 3,914,830 tons, or 108.2 per cent, and open-hearth steel, 2,564,321 tons, or 534.2 per cent; whereas for the decade from 1880 to 1890, Bessemer steel increased 2,737,548 tons, or 311.2 per cent, and open-hearth steel, 404,766 tons, or 537.8 per cent. Crucible and miscellaneous steels show a slight decrease.

Pennsylvania contributed 56.6 per cent of the total steel product in 1905, 60.2 per cent in 1900, 63.5 per cent in 1890, and 57.1 per cent in 1880. Ohio made 18.5 per cent in 1905, 17 per cent in 1900, 9.5 per cent in 1890, and 9.4 per cent in 1880. Illinois, ranking third in the production of steel, made 11.4 per cent in 1905, 13.7 per cent in 1900, 18.7 per cent in 1890, and 22.1 per cent in 1880. These 3 states combined produced 86.5 per cent of the total in 1905, 90.8 per cent in 1900, 91.7 per cent in 1890, and 88.6 per cent in 1880. A large increase appears in a number of the other states, notably in Alabama and New York. Delaware, Rhode Island, and Oregon appear as steel producers for the first time in 1905.

Table 50 shows the daily capacity of all steel plants, active and idle, on double turn, together with the production of steel ingots and castings, by states, for 1905.

TABLE 50.—STEEL WORKS—CAPACITY OF PLANTS AND QUANTITY AND VALUE OF STEEL INGOTS AND CASTINGS, BY STATES: 1905.

STATE OR GROUP OF STATES.	DAILY CAPACITY (TONS).			INGOTS AND CASTINGS.					
	Total.	Active.	Idle.	Total.		Ingots.		Castings.	
				Tons.	Value.	Tons.	Value.	Tons.	Value.
United States	81,751	78,346	3,405	[1] 13,670,592	[1] $261,231,976	13,379,083	$240,284,576	[1] 291,509	[1] $20,947,400
Alabama	1,935	1,890	45	227,899	4,487,289	226,152	4,435,080	1,747	52,209
California, Colorado, Missouri, Oregon, and Washington	2,796	2,792	4	196,769	4,004,533	188,464	3,398,805	8,305	605,728
Connecticut	380	380	....	47,307	1,203,092	44,861	881,542	2,446	321,550
Delaware, Rhode Island, and Massachusetts	1,458	1,442	16	130,013	2,862,935	128,665	2,701,828	1,348	161,107
Illinois	9,382	9,382	....	1,555,198	32,742,473	1,499,160	28,594,214	56,038	4,148,259
Indiana	638	498	140	81,589	1,845,603	72,090	1,290,156	9,499	555,447
Kentucky and Maryland	2,950	2,800	150	399,091	6,921,982	399,091	6,921,982	....	....
Michigan, Minnesota, and Wisconsin	403	103	300	11,862	1,080,870	....	....	11,862	1,080,870
New Jersey	922	922	....	68,288	3,009,268	56,632	1,602,951	11,656	1,406,317
New York	3,243	2,313	930	474,258	11,456,512	438,653	9,464,734	35,605	1,991,778
Ohio	14,401	13,780	621	2,529,997	42,949,759	2,492,401	40,462,006	37,596	2,487,753
Pennsylvania	41,971	40,772	1,199	7,733,640	144,774,781	7,618,833	136,680,399	114,807	8,094,382
Tennessee, Virginia, and West Virginia	1,272	1,272	....	214,681	3,892,879	214,081	3,850,879	600	42,000

[1] Includes 4,184 tons of steel castings, valued at $347,264, made by establishments engaged primarily in the manufacture of other products.

Computed from the daily capacity, on a basis of three hundred working days for the year, the total yearly capacity of the active establishments is about 23,500,000 tons. The production was thus approximately 58 per cent of the capacity of the active establishments. In 1900 it was estimated as 66.3 per cent of the total capacity of active establishments. Steel ingots constituted 97.9 per cent of the production and castings 2.1 per cent. In 1900 ingots formed 98.3 per cent and castings 1.7 per cent of the steel production. The average value per ton of all ingots and castings was $19.11 in 1905 and $19.89 in 1900.

Table 51 presents, for 1905, the statistics of the production of steel ingots, by states, certain states being grouped, as in the other tables, to avoid disclosing individual operations.

TABLE 51.—STEEL WORKS—QUANTITY AND VALUE OF STEEL INGOTS, BY KIND AND STATES: 1905.

STATE OR GROUP OF STATES.	AGGREGATE.		BESSEMER.		OPEN-HEARTH.						CRUCIBLE.	
					Total.		Acid.		Basic.			
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
United States	13,379,083	$240,284,576	7,754,488	$132,951,636	5,548,396	$101,762,469	573,475	$12,967,630	4,974,921	$88,794,839	76,199	$5,570,471
Alabama	226,152	4,435,080	....	....	226,152	4,435,080	....	....	226,152	4,435,080	....	....
Colorado, Illinois, New Jersey, New York, and Tennessee	2,182,915	43,061,904	1,657,253	32,022,549	513,774	10,039,554	7,886	186,649	505,888	9,852,905	11,888	999,801
Connecticut, Massachusetts, and Rhode Island	173,526	3,583,370	....	....	168,928	3,353,475	33,774	698,964	135,154	2,654,511	4,598	229,895
Indiana, Kentucky, Maryland, and West Virginia	685,256	12,061,817	606,166	10,626,661	79,090	1,435,156	....	....	79,090	1,435,156	....	....
Ohio	2,492,401	40,462,006	2,049,153	33,081,692	443,248	7,380,314	43,326	695,351	399,922	6,684,963	....	....
Pennsylvania	7,618,833	136,680,399	3,441,916	57,220,734	4,117,204	75,118,890	488,489	11,386,666	3,628,715	63,732,224	59,713	4,340,775

Of the total ingot production, 58 per cent was Bessemer, 41.5 per cent open-hearth, and six-tenths of 1 per cent crucible; whereas in 1900, 71.6 per cent was Bessemer, 27.4 per cent open-hearth, and 1 per cent crucible. The average value for all ingots was $17.96 per ton; for Bessemer ingots, $17.15 per ton; for open-hearth ingots, $18.34 per ton; and for crucible steel ingots, $73.10 per ton. In 1900 the average values were—for all ingots, $18.84 per ton; for Bessemer, $17.51; for open-hearth, $20.44; and for crucible steel, $72.33.

Table 52 presents, for 1905, the statistics relating to direct steel castings. Those made by miscellaneous steel furnaces, amounting to 431 tons, are combined with the crucible steel castings.

TABLE 52.—STEEL WORKS—QUANTITY AND VALUE OF STEEL CASTINGS, BY KIND AND STATES: 1905.

STATE OR GROUP OF STATES.	TOTAL.		BESSEMER.		OPEN-HEARTH.		CRUCIBLE AND MISCELLANEOUS.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
United States	[1] 291,509	[1] $20,947,400	14,427	$1,690,629	272,001	$18,739,813	5,081	$516,958
Alabama, California, Colorado, Oregon, Tennessee, and Missouri	10,652	699,937	1,517	56,644	8,535	601,293	600	42,000
Connecticut, Massachusetts, Delaware, New Jersey, New York, and Rhode Island	51,055	3,880,752	7,488	1,185,228	42,467	2,607,770	1,100	87,754
Illinois, Indiana, Michigan, Minnesota, and Wisconsin	77,399	5,784,576	5,026	395,794	69,950	5,153,571	2,423	235,211
Ohio	37,596	2,487,753			37,596	2,487,753		
Pennsylvania	114,807	8,094,382	396	52,963	113,453	7,889,426	958	151,993

[1] Includes 4,184 tons of steel castings, valued at $347,264, made by establishments engaged primarily in the manufacture of other products.

Of the total amount, 93.3 per cent was made of open-hearth steel, 4.9 per cent of Bessemer, and 1.7 per cent of crucible and miscellaneous steel. In 1900, 93.4 per cent was open-hearth, 2.1 per cent Bessemer, and 4.4 per cent crucible and miscellaneous. The average value per ton of all castings was $71.86; of Bessemer castings, $117.19; of open-hearth castings, $68.90; and of those made of crucible and miscellaneous steels, $101.74. The value of direct steel castings reported shows a wide range—from $26 per ton in certain sections to $175 per ton in others. In 1900 the average value per ton of all castings was $82.47; of Bessemer castings, $85.74; of open-hearth castings, $78.56; and of crucible and miscellaneous steels, $163.09.

Bessemer steel.—The production of Bessemer steel ingots and castings, and the equipment of all establishments, active and idle, for such production, is shown, for 1905, in Table 53.

TABLE 53.—BESSEMER STEEL WORKS—NUMBER, EQUIPMENT, AND CAPACITY OF ESTABLISHMENTS, AND QUANTITY AND VALUE OF INGOTS AND CASTINGS, BY STATES: 1905.

STATE OR GROUP OF STATES.	NUMBER OF ESTABLISHMENTS.			CONVERTERS.				INGOTS AND CASTINGS.					
				Active.		Idle.		Total.		Ingots.		Castings.	
	Total.	Active.	Idle.	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Tons.	Value.	Tons.	Value.	Tons.	Value.
United States	[1] 49	44	5	92	43,123	11	2,304	7,768,915	$134,642,265	7,754,488	$132,951,636	[2] 14,427	[2] $1,690,629
California, Colorado, Illinois, and Oregon	7	7		15	9,239			1,297,404	24,851,836	1,296,333	24,804,149	1,071	47,687
Kentucky, Alabama, Maryland, Virginia, and West Virginia	6	[illegible]		11	4,464			607,343	10,656,086	606,166	10,626,661	1,177	29,425
Michigan, Minnesota, and Wisconsin	5	4	1	6	60	2	300	4,295	375,326			4,295	375,326
New York, New Jersey, Delaware, Rhode Island, and Massachusetts	[illegible]	8	1	18	1,593	3	800	368,408	8,403,628	360,920	7,218,400	7,488	1,185,228
Ohio	8	7	1	13	10.838	2	550	2,049,153	33,081,692	2,049,153	33,081,692		
Pennsylvania	14	12	2	29	16,929	4	654	3,442,312	57,273,697	3,441,916	57,220,734	396	52,963

[1] Including 8 establishments other than steel works. (See Table 13.)
[2] Includes 774 tons of steel castings, valued at $92,685, made by establishments engaged primarily in the manufacture of other products.

The above table does not include 2 converters of the Tropenas type in Government establishments. It does, however, include the Bessemer equipment of the establishments otherwise classified (see Table 13).

Table 54 shows, for 1905, the equipment of all Bessemer steel works with the types of converters and the daily capacity, by states.

TABLE 54.—BESSEMER STEEL WORKS—NUMBER, KIND, AND CAPACITY OF CONVERTERS, BY STATES: 1905.

STATE.	TOTAL.			BESSEMER.			TROPENAS.			OTHER KINDS.		
	Number of establishments.	Number of converters.	Daily capacity (tons).	Number of establishments.	Number of converters.	Daily capacity (tons).	Number of establishments.	Number of converters.	Daily capacity (tons).	Number of establishments.	Number of converters.	Daily capacity (tons).
United States	[1] 51	105	45,432	30	72	44,979	10	15	100	11	18	353
Alabama	1	1	500	1	1	500						
California	1	1	8				1	1	8			
Colorado	1	2	2,000	1	2	2,000						
Delaware	1	3	30							1	[2] 3	30
District of Columbia	1	1	1				1	1	1			
Illinois	4	11	7,227	3	8	7,200	1	3	27			
Kentucky	1	2	500	1	2	500						
Maryland	1	3	2,200	1	3	2,200						
Massachusetts	2	2	204				1	1	4	1	[3] 1	200
Michigan	1	2	18							1	[4] 2	18
Minnesota	1	1	4				1	1	4			
New Jersey	3	6	45							3	[5] 6	45
New York	3	9	2,110	2	7	2,090	1	2	20			
Ohio	8	15	11,388	7	14	11,380				1	[4] 1	8
Oregon	1	1	4							1	[6] 1	4
Pennsylvania	14	33	17,583	11	29	17,549	2	3	24	1	[2] 1	10
Rhode Island	1	2	8				1	2	8			
Virginia	1	1	4				1	1	4			
West Virginia	2	4	1,260	2	4	1,260						
Wisconsin	3	5	338	1	2	300				2	[7] 3	38

[1] Includes 8 establishments other than steel works (see Table 13) and 2 Government institutions (District of Columbia and Massachusetts) having 2 Tropenas converters.
[2] Bookwalter.
[3] Clapp-Griffiths.
[4] Robert-Bessemer.
[5] Two Evans-Wills converters of 16 tons daily capacity, 3 top-blown converters of 9 tons daily capacity, and 1 special converter of 20 tons daily capacity.
[6] Top-blown.
[7] Special.

In 1880 the usual capacity of the standard Bessemer converter was 5 tons, and in 1890 converters of 10 to 12 tons were in use. In 1900 the capacity of a number of converters had further increased to 15 tons, and at one establishment 20-ton converters had been installed. This capacity has not been exceeded.

Nineteen states report plants equipped with converters. The total production of steel ingots and castings in 1905 amounted to 7,768,915 tons, valued at $134,642,265, as compared with 7,532,028 tons in 1900, of a value of $132,113,984, an increase of 3.1 per cent in tonnage and of 1.9 per cent in value. The ingot product of 1905 amounted to 7,754,488 tons, of a value of $132,951,636, an average value of $17.15, compared with 7,528,267 tons in 1900, valued at $131,791,519, or $17.51 per ton. The castings amounted in 1905 to 14,427 tons, of a value of $1,690,-629, an average value of $117.19 per ton, as compared with 3,761 tons in 1900, valued at $322,465, or $85.74 per ton. This is an increase for ingots of 3 per cent in tonnage and for castings, of 283.6 per cent. Pennsylvania produced 44.3 per cent of the total products of Bessemer ingots and castings in 1905, compared with 51.9 per cent in 1900; and Ohio, 26.4 per cent, compared with 22.5 per cent.

The states of Pennsylvania, Ohio, Illinois, and New York produced 90.8 per cent of all Bessemer steel ingots and castings in 1905; no other state produced over 4 per cent. Over 60 per cent of the Bessemer steel castings was produced by the state of New York. The next states in rank were New Jersey, Michigan, Wisconsin, Alabama, Delaware, and Illinois, in the order named. No other state produced over 400 tons of direct Bessemer steel castings.

Included in the foregoing is the product of all converters, whether of the standard Bessemer or other type. The product of the Tropenas and of converters other than standard Bessemer amounted to 11,834 tons of castings, of a value of $1,596,476, making an average value of $134.90 per ton. The tonnage and value of castings made by the establishments before referred to as otherwise classified are not of course included unless these were sold as products.

Of the Bessemer steel castings made by other than standard Bessemer converters, New Jersey produced 35.6 per cent; Michigan, 21.5 per cent; New York, 14.5 per cent; and Wisconsin, 14 per cent. No other state produced over 7.4 per cent.

Open-hearth steel.—The production and value of all open-hearth steel ingots and castings, acid and basic, is shown, for 1905, in Table 55, by states, together with the number of establishments, both active and idle, equipped with open-hearth furnaces.

TABLE 55.—OPEN-HEARTH STEEL WORKS—NUMBER OF ESTABLISHMENTS AND FURNACES, AND QUANTITY AND VALUE OF STEEL PRODUCED, BY STATES: 1905.

STATE OR GROUP OF STATES.	NUMBER OF ESTABLISHMENTS.			NUMBER OF FURNACES.			STEEL (INGOTS AND CASTINGS).					
							Total.		Acid.		Basic.	
	Total.	Active.	Idle.	Total.	Active.	Idle.	Tons.	Value.	Tons.	Value.	Tons.	Value.
United States	126	110	16	515	489	26	[1] 5,820,397	[1] $120,502,282	755,805	$25,931,780	[1] 5,064,592	[1] $94,570,502
Alabama	5	4	1	19	18	1	226,722	4,457,864	....	....	226,722	4,457,864
California, Colorado, Missouri, and Wisconsin	6	6	.....	15	15	.....	98,847	2,602,584	6,513	603,868	92,334	1,998,716
Connecticut, Massachusetts, Rhode Island, Delaware, Maryland, Kentucky, and Tennessee	12	10	2	33	28	5	178,374	3,820,029	36,220	1,020,514	142,154	2,799,511
Illinois	9	9	.....	38	38	.....	361,650	9,819,919	23,356	1,730,527	338,294	8,089,392
Indiana	6	4	2	12	9	3	80,799	1,788,603	8,709	498,447	72,090	1,290,156
New Jersey	5	5	.....	13	13	.....	57,606	1,793,496	14,422	785,315	43,184	1,008,181
New York	8	6	2	21	17	4	104,898	3,343,408	19,077	954,092	85,821	2,389,316
Ohio [1]	15	12	3	46	43	3	480,844	9,868,067	55,837	1,428,511	425,007	8,439,556
Pennsylvania	60	54	6	318	308	10	4,230,657	83,008,316	591,671	18,910,506	3,638,986	64,097,810

[1] Includes 2,440 tons of steel castings, valued at $179,575, made by establishments engaged primarily in the manufacture of other products.

The production of open-hearth steel ingots and castings in 1905 was 5,820,397 tons, as compared with 3,044,356 tons in 1900, 480,035 tons in 1890, and 75,269 tons in 1880. This shows an increase of 91.2 per cent for the five-year period from 1900 to 1905, compared with 534.2 per cent for the decade ending 1900, and 537.8 for that ending in 1890.

In 1900 there were 96 establishments equipped with 331 open-hearth furnaces, of which 82 establishments, having 307 furnaces, were active, and 14 establishments, with 24 furnaces, were idle. In 1905, 126 establishments report 515 open-hearth furnaces, an increase of over 30 per cent in number of establishments, and of 55.6 per cent in number of furnaces. In 1880 the open-hearth furnaces ranged from 7 to 10 tons capacity per heat; in 1890 many furnaces handled from 20 to 30 tons; and in 1900 a large number of furnaces of 50-ton capacity were in use. In 1905 there were reported 6 open-hearth furnaces of a capacity of 60 tons at a heat, and 169 of a capacity of 50 tons.

The 489 active furnaces in 1905 show an average product for the year of 11,903 tons per furnace, whereas in 1900 the 307 active furnaces had an average product of 9,916 tons per furnace for the year.

In 1905, 87 per cent of the open-hearth steel was made in basic furnaces and 13 per cent in acid, compared with a production in 1900 of 70.7 per cent basic steel and 29.3 per cent acid steel. In fact, the production of acid open-hearth steel declined from 890,521 tons in 1900 to 755,805 tons in 1905, or a decrease of 15.1 per cent, and basic open-hearth steel advanced from 2,153,835 tons in 1900 to 5,064,592 tons in 1905, an increase of 135.1 per cent.

The average value per ton of all open-hearth steel made in 1905 was $20.70, acid steel being $34.31 per ton, and basic $18.67 per ton. In 1900 the average value of all open-hearth steel was $23.60 per ton; of acid steel, $31.83 per ton; and of basic, $20.20 per ton.

Acid open-hearth steel was made in 11 states. Pennsylvania produced 78.3 per cent of the total product, compared with 77.6 per cent in 1900; Ohio, 7.4 per cent, compared with 5.9 per cent in 1900; Illinois, 3.1 per cent, compared with 3.9 per cent in 1900.

Basic open-hearth steel was made in 13 states in 1905. Pennsylvania produced 71.9 per cent, as compared with 81.1 per cent of the total production in 1900; Ohio, 8.4 per cent, compared with 2.9 per cent in 1900; and Illinois, 6.7 per cent, compared with 10 per cent in 1900.

Acid steel only was produced by 46 active open-hearth establishments, basic steel only by 40 establishments, and both acid and basic steel by 19 establishments. In the case of 5 active establishments having open-hearth furnaces, no open-hearth steel was reported. In 1900, 36 of the active establishments produced acid steel only; 19, basic steel; and 17, both acid and basic. In 1905, 46 of the open-hearth establishments produced ingots only; 44, castings only; and 15, both ingots and castings. In 1900, 38 establishments made ingots alone; 32, castings alone; and 12, both ingots and castings.

Table 56 presents in detail, for 1905, by states or groups of states, the production and value of acid and basic steel ingots and castings.

TABLE 56.—OPEN-HEARTH STEEL WORKS—QUANTITY AND VALUE OF INGOTS AND CASTINGS, BY KIND AND STATES: 1905.

STATE OR GROUP OF STATES.	Number of producing establishments.	ACID AND BASIC.					
		Total.		Ingots.		Castings.	
		Tons.	Value.	Tons.	Value.	Tons.	Value.
United States	100	[1] 5,820,397	[1] $120,502,282	5,548,396	$101,762,469	[1] 272,001	[1] $18,739,813
Connecticut, Massachusetts, and Rhode Island	6	171,374	3,675,025	168,928	3,353,475	2,446	321,550
Maryland and New Jersey	4	64,606	1,938,496	58,037	1,339,196	6,569	599,300
Missouri, Wisconsin, Colorado, and California	5	98,847	2,602,584	84,948	1,496,742	13,899	1,105,842
Alabama	4	226,722	4,457,864	226,152	4,435,080	570	22,784
Illinois	8	361,650	9,819,919	306,343	5,692,128	55,307	4,127,791
Indiana	4	80,799	1,788,603	72,090	1,290,156	8,709	498,447
New York	6	104,898	3,343,408	71,446	1,656,488	33,452	1,686,920
Ohio	12	480,844	9,868,067	443,248	7,380,314	37,596	2,487,753
Pennsylvania	51	4,230,657	83,008,316	4,117,204	75,118,890	113,453	7,889,426

STATE OR GROUP OF STATES.	Number of producing establishments.	ACID.					
		Total.		Ingots.		Castings.	
		Tons.	Value.	Tons.	Value.	Tons.	Value.
United States	100	755,805	$25,931,780	573,475	$12,967,630	182,330	$12,964,150
Connecticut, Massachusetts, and Rhode Island	6	36,220	1,020,514	33,774	698,964	2,446	321,550
Maryland and New Jersey	4	14,422	785,315	7,853	186,015	6,569	599,300
Missouri, Wisconsin, Colorado, and California	5	6,513	603,868			6,513	603,868
Alabama	4						
Illinois	8	23,356	1,730,527	33	634	23,323	1,729,893
Indiana	4	8,709	498,447			8,709	498,447
New York	6	19,077	954,092			19,077	954,092
Ohio	12	55,837	1,428,511	43,326	695,351	12,511	733,160
Pennsylvania	51	591,671	18,910,506	488,489	11,386,666	103,182	7,523,840

STATE OR GROUP OF STATES	Number of producing establishments.	BASIC.					
		Total.		Ingots.		Castings.	
		Tons.	Value.	Tons.	Value.	Tons.	Value.
United States	100	[1] 5,064,592	[1] $94,570,502	4,974,921	$88,794,839	[1] 89,671	[1] $5,775,663
Connecticut, Massachusetts, and Rhode Island	6	135,154	2,654,511	135,154	2,654,511		
Maryland and New Jersey	4	50,184	1,153,181	50,184	1,153,181		
Missouri, Wisconsin, Colorado, and California	5	92,334	1,998,716	84,948	1,496,742	7,386	501,974
Alabama	4	226,722	4,457,864	226,152	4,435,080	570	22,784
Illinois	8	338,294	8,089,392	306,310	5,691,494	31,984	2,397,898
Indiana	4	72,090	1,290,156	72,090	1,290,156		
New York	6	85,821	2,389,316	71,446	1,656,488	14,375	732,828
Ohio	12	425,007	8,439,556	399,922	6,684,963	25,085	1,754,593
Pennsylvania	51	3,638,986	64,097,810	3,628,715	63,732,224	10,271	365,586

[1] Includes 2,440 tons of steel castings, valued at $179,575, made by establishments engaged primarily in the manufacture of other products.

Of the total open-hearth steel production, 95.3 per cent was ingots and 4.7 per cent castings; 87 per cent was made in basic furnaces and 13 per cent in acid. Of the ingots, 89.7 per cent were basic and 10.3 per cent acid; while of the castings, 67 per cent were of acid steel and 33 per cent basic.

The average value of the ingots was $18.34 per ton; of the basic ingots, $17.85 per ton; and of the acid, $22.61 per ton. The average value of the castings was $68.90 per ton; of the acid castings, $71.10 per ton; and of the basic, $64.41 per ton. Pennsylvania made 72.7 per cent of all open-hearth steel, and the average value of its contribution was $19.62 per ton; 74.2 per cent of all ingots, their average value being $18.25 per ton; 72.9 per cent of the basic ingots, at $17.56 per ton; 85.2 per cent of the acid ingots, at $23.31 per ton; and 41.7 per cent of all castings, at $69.54 per ton—56.6 per cent of the acid at $72.92 per ton, and 11.5 per cent of the basic at $35.59 per ton.

Ohio was second in the production of all open-hearth steel, making 8.3 per cent, at $20.52 per ton; second in the production of ingots, making 8 per cent, at $16.65 per ton; 8 per cent of the basic ingots, at $16.72 per ton; and 7.6 per cent of the acid ingots, at $16.05 per ton; and third in castings, making 13.8 per cent, at $66.17 per ton.

Illinois was third in all open-hearth steel, making 6.2 per cent, at $27.15 per ton; third in ingots, making 5.5 per cent, nearly all basic ingots (and 6.2 per cent of the total basic), at $18.58 per ton; and second in castings, making 20.3 per cent, at $74.63 per ton.

Alabama was fourth in all open-hearth steel production, making 3.9 per cent, at $19.66 per ton; fourth in the production of ingots, its output constituting 4.1

per cent of all ingots and 4.5 per cent of all basic ingots, at $19.61 per ton; it produced also a relatively small amount of basic castings.

These 4 states—Pennsylvania, Ohio, Illinois, and Alabama—made 5,299,873 tons of open-hearth steel, or 91.1 per cent of the total amount; 5,092,947 tons of ingots, or 91.8 per cent of the total; and 206,926 tons of castings, or 76.1 per cent of the total.

There were 54 establishments which made open-hearth steel castings in 1905, 35 made acid castings only, 12 basic castings only, and 7 made both acid and basic. The establishments which made steel castings only and no steel ingots were equipped with 56 acid open-hearth furnaces and with 31 basic furnaces. Of the 44 establishments which made open-hearth castings in 1900, 39 made acid castings only, 4 basic castings only, and 1 both acid and basic. The establishments which produced steel castings only in 1900 were equipped with 51 acid and 9 basic furnaces.

The average value per ton of all open-hearth steel castings was $68.90 in 1905 and $78.56 in 1900. Acid castings had an average value of $71.10 per ton in 1905, and basic an average value of $64.41. Pennsylvania produced 41.7 per cent of the total output in 1905, of an average value of $69.54 per ton, as compared with 41.2 per cent of the total output, of an average value of $81.43, in 1900. Pennsylvania made 56.6 per cent of the acid castings, of an average value of $72.92 per ton in 1905, and 50.2 per cent, of a value of $83.27, in 1900.

Illinois ranked second in the manufacture of all steel castings, Ohio third, and New York fourth. In output of acid castings, Illinois was second, New York third, and Ohio fourth; and of basic, Illinois was first, Ohio second, New York third, and Pennsylvania fourth. In 1900 basic steel castings were made in only 3 states—Illinois, Missouri, and Pennsylvania; in 1905 they are reported by 7 states—the 3 mentioned above and Alabama, Colorado, New York, and Ohio.

Table 57 shows the number and capacity of the open-hearth furnaces, acid and basic, in active and idle establishments, including those "otherwise classified" (see Table 13), by states. In order to show the heavy increase in the basic open-hearth furnace equipment since the Twelfth Census, the statistics are presented for both 1900 and 1905.

TABLE 57.—OPEN-HEARTH STEEL WORKS—NUMBER AND DAILY CAPACITY OF ACID AND BASIC FURNACES, BY STATES: 1905 AND 1900.

STATE.	Census.	Number of establishments.	TOTAL OPEN-HEARTH FURNACES.						ACID FURNACES.						BASIC FURNACES.					
			Total.		Active.		Idle.		Total.		Active.		Idle.		Total.		Active.		Idle.	
			Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).	Number.	Daily capacity (tons).
United States	[1] 1905	126	515	35,457	489	34,398	26	1,059	159	7,750	148	7,466	11	284	356	27,707	341	26,932	15	775
	1900	96	331	19,030	307	18,245	24	785	152	6,419	139	6,094	13	325	179	12,611	168	12,151	11	460
Alabama	1905	5	19	1,435	18	1,390	1	45							19	1,435	18	1,390	1	45
	1900	3	13	1,150	12	1,120	1	30							13	1,150	12	1,120	1	30
California	1905	1	1	20	1	20			1	20	1	20								
	1900																			
Colorado	1905	1	6	600	6	600									6	600	6	600		
	1900																			
Connecticut	1905	3	6	370	6	370			3	140	3	140			3	230	3	230		
	1900	1	1	10	1	10			1	10	1	10								
Delaware	1905	1	5	460	5	460			1	100	1	100			4	360	4	360		
	1900																			
Illinois	1905	9	38	2,131	38	2,131			5	237	5	237			33	1,894	33	1,894		
	1900	6	26	1,578	24	1,498	2	80	6	303	4	223	2	80	20	1,275	20	1,275		
Indiana	1905	6	12	624	9	484	3	140	6	104	5	84	1	20	6	520	4	400	2	120
	1900	5	8	333	8	333			5	203	5	203			3	130	3	130		
Kentucky	1905	1	3	150			3	150	3	150			3	150						
	1900	2	5	214			5	214	1	14			1	14	4	200			4	200
Maryland	1905	1	2	100	2	100									2	100	2	100		
	1900	1	1	30	1	30			1	30	1	30								
Massachusetts	1905	4	14	650	12	635	2	15	9	240	7	225	2	15	5	410	5	410		
	1900	3	10	576	10	576			8	440	8	440			2	136	2	136		
Michigan	1905																			
	1900	1	1	30	1	30			1	30	1	30								
Minnesota	1905																			
	1900	2	4	140	3	100	1	40	1	40			1	40	3	100	3	100		
Missouri	1905	1	5	160	5	160									5	160	5	160		
	1900	1	3	42	3	42									3	42	3	42		
New Jersey	1905	5	13	825	13	825			4	267	4	267			9	558	9	558		
	1900	4	9	335	7	310	2	25	6	225	5	210	1	15	3	110	2	100	1	10
New York	1905	8	21	1,095	17	965	4	130	6	226	6	226			15	869	11	739	4	130
	1900	6	12	350	8	190	4	160	7	126	5	86	2	40	5	224	3	104	2	120

[1] Includes 6 establishments other than steel works. (See Table 13.)

TABLE 57.—OPEN-HEARTH STEEL WORKS—NUMBER AND DAILY CAPACITY OF ACID AND BASIC FURNACES, BY STATES: 1905 AND 1900—Continued.

STATE.	Census.	Number of establishments.	Total open-hearth furnaces: Total: Number.	Total open-hearth furnaces: Total: Daily capacity (tons).	Total open-hearth furnaces: Active: Number.	Total open-hearth furnaces: Active: Daily capacity (tons).	Total open-hearth furnaces: Idle: Number.	Total open-hearth furnaces: Idle: Daily capacity (tons).	Acid furnaces: Total: Number.	Acid furnaces: Total: Daily capacity (tons).	Acid furnaces: Active: Number.	Acid furnaces: Active: Daily capacity (tons).	Acid furnaces: Idle: Number.	Acid furnaces: Idle: Daily capacity (tons).	Basic furnaces: Total: Number.	Basic furnaces: Total: Daily capacity (tons).	Basic furnaces: Active: Number.	Basic furnaces: Active: Daily capacity (tons).	Basic furnaces: Idle: Number.	Basic furnaces: Idle: Daily capacity (tons).
Ohio	1905	15	46	3,012	43	2,942	3	70	12	608	9	538	3	70	34	2,404	34	2,404		
	1900	8	29	1,272	27	1,218	2	54	15	532	13	478	2	54	14	740	14	740		
Pennsylvania	1905	60	318	23,704	308	23,195	10	509	105	5,627	103	5,598	2	29	213	18,077	205	17,597	8	480
	1900	49	205	12,925	199	12,745	6	180	96	4,421	93	4,341	3	80	109	8,504	106	8,404	3	100
Rhode Island	1905	1	2	90	2	90									2	90	2	90		
	1900																			
Tennessee	1905	1	1	6	1	6			1	6	1	6								
	1900	1	1	6	1	6			1	6	1	6								
Wisconsin	1905	3	3	25	3	25			3	25	3	25								
	1900	3	3	39	2	37	1	2	3	39	2	37	1	2						

The number of establishments having open-hearth furnace equipment increased 31.3 per cent, the number of furnaces 55.6 per cent, and the furnace capacity 86.3 per cent. The growth has been chiefly in the basic furnaces, which increased in number 98.9 per cent and in capacity 119.7 per cent. In 1905 the average daily capacity per furnace (double turn) for all furnaces was 68.8 tons; for acid furnaces, 48.7 tons; and for basic furnaces, 77.8 tons; compared with corresponding figures for 1900 of 57.5 tons, 42.2 tons, and 70.5 tons, respectively. The basic furnaces in 1905 constituted 69.1 per cent of the total number and 78.1 per cent of the total capacity; in 1900 they formed 54.1 per cent of the total number and 66.3 per cent of the total capacity.

Crucible and miscellaneous steels.—Table 58 shows the equipment, capacity, and production of the crucible steel works, by states, for 1905. Some of the states are grouped, in order not to disclose individual operations.

TABLE 58.—CRUCIBLE STEEL WORKS—NUMBER, EQUIPMENT, AND CAPACITY OF ESTABLISHMENTS, AND QUANTITY AND VALUE OF INGOTS AND CASTINGS, BY STATES: 1905.

STATE OR GROUP OF STATES.	Number of establishments: Total.	Number of establishments: Active.	Number of establishments: Idle.	Number of pots that can be used at a heat: Total.	Number of pots that can be used at a heat: Active.	Number of pots that can be used at a heat: Idle.	Daily capacity (tons): Total.	Daily capacity (tons): Active.	Daily capacity (tons): Idle.	Ingots and castings: Total: Tons.	Ingots and castings: Total: Value.	Ingots: Tons.	Ingots: Value.	Castings: Tons.	Castings: Value.
United States	[1] 49	[1] 44	5	2,939	2,723	216	759	717	42	80,059	$5,958,572	76,199	$5.570,471	[2] 3,860	[2] $388,101
Connecticut, Massachusetts, and New York	6	5	1	301	277	24	51	50	1	11,075	839,995	10,885	819,741	190	20,254
Indiana, Illinois, Ohio, Tennessee, and Wisconsin	13	11	2	280	220	60	35	30	5	2,239	221,411	6	1,200	2,233	220,211
New Jersey	4	4		248	248		52	52		6,505	476,255	5,595	408,755	910	67,500
Pennsylvania	26	24	2	2,110	1,978	132	621	585	36	60,240	4,420,911	59,713	4,340,775	527	80,136

[1] Includes 6 establishments other than steel works. (See Table 13.)
[2] Includes 180 tons of steel castings, valued at $18,004, made by establishments engaged primarily in the manufacture of other products.

In 1880 the production of crucible steel amounted to 68,037 tons; in 1890, to 73,882 tons; in 1900, to 104,393 tons; and in 1905, to 80,059 tons. In 1880 there were 37 establishments, located in 9 states; in 1890, 47, located in 11 states; in 1900, 40, located in 10 states; and in 1905, 49, located in 10 states.

In 1905 the average value per ton of all crucible steel was $74.43. Of the total amount, 95.2 per cent were ingots of an average value of $73.10 per ton, and 4.8 per cent castings of an average value of $100.54 per ton. For 1900 the average value of all crucible steel was $74.46 per ton; of ingots, $72.33 per ton; and castings, $133.53. In 1900 ingots constituted 96.5 per cent and castings 3.5 per cent of all crucible steel.

Pennsylvania made about three-fourths of all crucible steel, and New Jersey, New York, and Massachusetts were next, in the order named. Wisconsin was the largest producer of crucible steel castings.

In 1900 there was reported a total of 2,619 pots that could be used at a heat, with a daily capacity of 525.5 tons.

The production of steel by other or miscellaneous processes is comparatively small. In 1880 there was reported 4,425 tons by miscellaneous processes from Connecticut, New Jersey, and Pennsylvania; in 1890, 3,537 tons from New Jersey and Pennsylvania; and in 1900, 4,223 tons from New Jersey and Pennsylvania. In 1905 steel made by miscellaneous processes was reported for Pennsylvania to the amount of 431 tons.

FORGES AND BLOOMERIES.

The statistics of the few remaining forges and bloomeries which manufacture for sale hammered charcoal blooms, billets, and bars direct from iron ore and hammered charcoal blooms, billets, and bars from pig iron and from scrap iron and steel, have been included for 1905 in those for steel works and rolling mills, but are here presented in detached form for comparison with former years. Establishments which consume in their own works the charcoal blooms or bars are not included.

Table 59 shows the leading statistics for forges and bloomeries for the census years 1870 to 1905.

TABLE 59.—*Forges and bloomeries—comparative summary: 1870 to 1905.*

	1905	1900	1890	1880	1870[1]
Number of establishments	6	7	20	93	[illegible]
Capital	[2]$222,112	[2]$508,388	$876,470	$3,915,213	$4,506,733
Salaried officials, clerks, etc., number	6	12	[3]15	(4)	(4)
Salaries	$4,935	$11,500	[3]$17,309	(4)	(4)
Wage-earners, average number	68	226	471	2,939	2,902
Total wages	$33,355	$97,184	$199,065	$915,395	$195,964
Men 16 years and over	68	226	468	2,875	2,819
Wages	$33,355	$97,184	$198,705	(4)	(4)
Women 16 years and over				3	2
Wages				(4)	(4)
Children under 16 years			3	61	81
Wages			$360	(4)	(4)
Miscellaneous expenses	$14,049	$15,203	$54,680	(5)	(5)
Cost of materials used	$100,233	$327,160	$905,208	$2,546,915	$5,685,466
Value of products[6]	$158,612	$522,432	$1,183,494	$3,968,074	$7,647,054
Tons of products	5,626	15,497	31,049	64,783	98,936

[1] Includes idle establishments which were not reported separately in 1870.
[2] Includes value of rented property—1905, $9,500; 1900, $236,000. No rented property reported for previous censuses.
[3] Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905, but not included in this table.
[4] Not reported separately.
[5] Not reported.
[6] Includes value of miscellaneous products for which tonnage was not reported.

In 1880 there were 93 active establishments manufacturing hammered blooms, bars, etc., located in Missouri, New Jersey, New York, Pennsylvania, Georgia, North Carolina, Tennessee, and Virginia. In 1890 the number had declined to 20, located in New York, Pennsylvania, Maryland, and New Jersey; and in 1900 was further reduced to 7, located in New York, Pennsylvania, and Maryland. In 1905 there were only 6 active establishments, of which 5 were located in Pennsylvania and 1 in Maryland.

Since 1900 a decrease is shown of $286,276, or 56.3 per cent, in capital invested; of 69.9 per cent in number of wage-earners employed; of 69.3 per cent in the cost of materials; of 69.6 per cent in the value of products; and of 63.7 per cent in the tonnage.

The capital invested in active and idle forges and bloomeries in 1905, 1900, 1890, and 1880 is shown in Table 60.

TABLE 60.—*Forges and bloomeries—active and idle establishments—capital: 1880 to 1905.*

	Census.	Number of establishments.	CAPITAL. Total.	CAPITAL. Buildings, machinery, tools, and implements.	CAPITAL. Land, cash, and sundries.
Total	1905	7	[1]$256,639	$70,681	$185,958
	1900	14	[1]619,488	236,420	383,068
	1890	32	1,074,970	462,500	612,470
	1880	118	4,395,963	2,301,550	2,094,413
Active	1905	6	222,112	37,154	184,958
	1900	7	508,388	184,420	323,968
	1890	20	876,470	338,000	538,470
	1880	93	3,915,213	2,018,800	1,896,413
Idle	1905	1	34,527	33,527	1,000
	1900	7	111,100	52,000	59,100
	1890	12	198,500	124,500	74,000
	1880	25	480,750	282,750	198,000

[1] Includes value of rented property—1905, $9,500; 1900, $236,000. No rented property reported for previous censuses.

The idle establishment in 1905 was in the state of New York. The materials and quantities and cost are shown in detail for 1880, 1890, 1900, and 1905 in Table 61.

TABLE 61.—FORGES AND BLOOMERIES—MATERIALS USED, BY KIND, QUANTITY, AND COST: 1880 TO 1905.

KIND.	1905		1900		1890		1880	
	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.
Total	....	$100,233	....	$327,160	....	$905,208	....	$2,546,915
Iron ore	....	....	6,282	22,414	16,792	110,587	71,080	531,540
Pig iron	50	1,097	1,000	22,000	7,346	145,867	34,029	945,375
Old or scrap iron and steel	5,544	78,149	13,693	181,766	21,429	359,777	7,976	215,576
Charcoal	[1] 164,749	15,222	[1] 1,538,280	85,241	[1] 4,056,435	270,082	[1] 13,014,361	812,615
Anthracite coal and culm	....	....	....	....	355	946	304	1,220
Bituminous coal and slack	994	2,301	1,553	2,771	1,161	3,300	1,440	4,298
Coke	[2] 29	97	[2] 67	240	[2] 1,404	5,604	[2] 6,695	31,241
All other materials	....	3,367	....	12,728	....	9,045	....	5,050

[1] Bushels.

[2] Short tons.

Table 62 shows the quantity and value of the products for 1880, 1890, 1900, and 1905. In 1880 and 1890 the cost of materials reported included all freight charges, whereas in 1900 and 1905 this was not always the case. Where freight is not included in the cost of materials it has been added to "all other materials."

The 1905 product was all blooms, billets, etc., nearly all of which were made from scrap iron and steel.

The blooms, billets, etc., had an average value of $28 per ton in 1905, compared with $32.63 per ton in 1900, $36.17 in 1890, and $68.31 in 1880.

TABLE 62.—FORGES AND BLOOMERIES—PRODUCTS, BY KIND, QUANTITY, AND VALUE: 1880 TO 1905.

KIND.	1905		1900		1890		1880	
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
Total	....	$158,612	....	$522,432	....	$1,183,494	....	$3,968,074
Blooms and bar iron direct from iron ore	....	....	3,142	114,413	8,346	356,843	33,601	1,812,380
Blooms, billets, etc., from pig iron and scrap iron and steel	5,626	157,505	12,355	403,194	22,704	821,168	31,182	2,129,933
All other products	....	1,107	....	4,825	....	5,483	....	25,761

TABLE 63.—BLAST FURNACES—DETAILED

		United States.	Alabama.	Georgia.	Illinois.	Michigan.
1	Number of establishments	190	19	4	4	11
2	Capital, total	$236,145,529	$19,325,778	$1,158,151	$14,263,055	$4,253,403
3	Land	$17,310,397	$1,289,655	$113,070	$1,801,500	$246,002
4	Buildings	$66,611,341	$5,831,477	$532,000	$3,212,352	$589,347
5	Machinery, tools, and implements	$67,804,248	$7,400,894	$103,207	$3,611,514	$1,112,792
6	Cash and sundries	$84,419,543	$4,803,752	$409,874	$5,637,689	$2,305,262
7	Rented property, total	$3,158,283				$129,703
8	Land	$787,184				$73,484
9	Buildings	$2,171,219				$51,219
10	Machinery, tools, and implements	$199,880				$5,000
11	Proprietors and firm members	26				
	Salaried officials, clerks, etc.:					
12	Total number	2,231	262	41	83	97
13	Total salaries	$2,890,897	$320,643	$44,838	$100,661	$109,596
	Officers of corporations—					
14	Number	249	46	7	7	3
15	Salaries	$683,704	$100,095	$15,977	$22,500	$8,200
	General superintendents, managers, clerks, etc.—					
16	Total number	1,982	216	34	76	94
17	Total salaries	$2,207,193	$220,548	$28,861	$78,161	$101,396
	Men—					
18	Number	1,922	216	33	75	91
19	Salaries	$2,177,422	$220,548	$28,446	$77,761	$100,336
	Women—					
20	Number	60		1	1	3
21	Salaries	$29,771		$415	$400	$1,060
	Wage-earners, including pieceworkers, and total wages:					
22	Greatest number employed at any one time during the year	47,361	6,595	434	2,542	1,517
23	Least number employed at any one time during the year	27,206	3,861	192	1,496	1,163
24	Average number	35,078	4,954	303	1,910	1,139
25	Total wages	$18,934,513	$1,939,208	$112,698	$1,397,969	$587,724
	Men 16 years and over—					
26	Average number	34,993	4,944	297	1,910	1,139
27	Wages	$18,916,382	$1,937,827	$111,690	$1,397,969	$587,724
	Women 16 years and over—					
28	Average number	4				
29	Wages	$954				
	Children under 16 years—					
30	Average number	81	10	6		
31	Wages	$17,177	$1,381	$1,008		
	Average number of wage-earners, including pieceworkers, employed during each month:					
	Men 16 years and over—					
32	January	32,846	5,359	351	1,335	902
33	February	35,319	5,043	345	1,816	1,158
34	March	36,762	5,028	346	2,139	1,194
35	April	37,002	5,078	326	2,247	1,296
36	May	37,084	5,268	321	2,114	1,337
37	June	35,070	5,258	230	1,982	1,336
38	July	33,130	4,936	214	1,866	1,067
39	August	32,791	4,589	214	1,954	1,052
40	September	33,333	4,661	212	2,029	1,100
41	October	33,892	4,613	383	1,915	1,109
42	November	35,203	4,712	310	1,816	1,071
43	December	37,484	4,783	312	1,707	1,046
	Women 16 years and over—					
44	January	4				
45	February	4				
46	March	4				
47	April	4				
48	May	4				
49	June	4				
50	July	4				
51	August	4				
52	September	4				
53	October	4				
54	November	4				
55	December	4				
	Children under 16 years—					
56	January	75	8	7		
57	February	76	8	10		
58	March	90	10	12		
59	April	90	10	8		
60	May	91	14	8		
61	June	84	11			
62	July	84	10			
63	August	79	9			
64	September	73	11			
65	October	76	10	9		
66	November	76	9	10		
67	December	78	10	8		
68	Miscellaneous expenses, total	$9,788,139	$445,152	$37,536	$958,945	$203,657
69	Rent of works	$242,415				$7,530
70	Taxes	$742,221	$59,785	$6,214	$13,410	$49,045
71	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$8,795,632	$385,367	$31,322	$945,535	$144,582
72	Contract work	$7,871				$2,500
73	Materials used, total cost	$178,941,918	$11,012,233	$720,836	$19,005,423	$3,104,136
	Iron ore—					
	Domestic—					
74	Tons	29,202,944	3,614,109	156,499	2,897,494	524,013
75	Cost	$96,206,246	$3,464,655	$256,459	$9,567,879	$1,414,942
	Foreign—					
76	Tons	829,918			18,487	
77	Cost	$4,739,123			$207,018	
	Mill cinder, scrap, etc.—					
78	Tons	1,865,385	5,662		174,737	100
79	Cost	$3,830,961	$15,682		$627,984	$1,000
	Fluxing materials—					
80	Tons	8,325,209	681,742	38,808	792,994	39,612
81	Cost	$6,888,647	$361,920	$24,503	$581,763	$37,213

[1] The figures for the various items in this table do not agree with the corresponding figures for 1905 in all other tables, because the figures for a blast furnace in Texas, operated by a penal institution, have been excluded. This institution reported $255,382 invested as capital; 5 salaried employees who were paid $7,020; 100 wage-earners who received $13,400; miscellaneous expenses, $3,000; materials costing $25,531; and 4,669 tons of charcoal pig iron, valued at $66,419, as products. The furnace has a daily capacity of 50 tons.

SUMMARY, BY STATES: 1905.[1]

New Jersey.	New York.	Ohio.	Pennsylvania.	Tennessee.	Virginia.	Wisconsin.	All other states.[2]	
5	9	33	65	13	10	4	13	1
$5,414,051	$14,644,730	$43,195,782	$107,741,803	$5,688,283	$3,157,268	$2,649,011	$14,654,214	2
$142,944	$1,411,647	$3,252,111	$6,575,146	$905,885	$455,000	$475,228	$642,209	3
$3,369,319	$4,243,122	$11,284,563	$30,663,936	$2,022,368	$1,102,883	$840,000	$2,919,974	4
$847,785	$2,418,989	$13,817,776	$29,638,673	$761,537	$726,279	$123,688	$7,241,114	5
$1,054,003	$6,570,972	$14,841,332	$40,864,048	$1,998,493	$873,106	$1,210,095	$3,850,917	6
	$544,180	$660,600	$1,572,300	$251,500				7
	$139,300	$315,600	$188,800	$70,000				8
	$375,000	$260,000	$1,305,000	$180,000				9
	$29,880	$85,000	$78,500	$1,500				10
1			24				1	11
32	76	395	891	128	60	39	118	12
$43,715	$157,145	$568,258	$1,113,956	$127,831	$81,865	$62,859	$159,530	13
1	13	47	65	21	20	5	14	14
$2,274	$73,810	$146,565	$183,632	$46,956	$28,175	$19,500	$36,020	15
31	63	348	826	107	49	34	104	16
$41,441	$83,335	$421,693	$930,324	$80,875	$53,690	$43,359	$123,510	17
30	62	335	796	103	47	33	101	18
$41,321	$82,997	$414,251	$915,208	$79,775	$52,490	$42,699	$121,590	19
1	1	13	30	4	2	1	3	20
$120	$338	$7,442	$15,116	$1,100	$1,200	$660	$1,920	21
974	2,127	7,817	18,138	2,103	1,384	679	3,051	22
711	1,380	3,409	11,170	1,272	1,013	246	1,293	23
774	1,559	5,434	13,867	1,358	1,081	482	2,217	24
$370,751	$1,161,179	$3,471,083	$7,763,931	$545,861	$346,471	$257,024	$980,614	25
774	1,558	5,431	13,836	1,336	1,074	482	2,212	26
$370,751	$1,160,975	$3,470,333	$7,755,189	$541,914	$344,865	$257,024	$980,121	27
	1	3						28
	$204	$750						29
			31	22	7		5	30
			$8,742	$3,947	$1,606		$493	31
809	1,398	4,886	13,236	1,416	1,222	452	1,480	32
765	1,412	5,660	14,382	1,460	1,211	469	1,598	33
761	1,389	6,261	14,674	1,410	1,218	530	1,812	34
815	1,393	6,365	14,417	1,351	1,200	567	1,947	35
777	1,393	6,125	14,405	1,331	1,158	570	2,285	36
705	1,525	5,326	13,448	1,366	1,157	450	2,287	37
771	1,615	4,474	13,050	1,279	1,102	420	2,336	38
757	1,606	4,595	13,152	1,206	933	330	2,403	39
753	1,495	5,107	13,148	1,179	887	360	2,402	40
780	1,624	5,118	13,306	1,202	876	476	2,490	41
777	1,863	5,339	13,817	1,295	909	547	2,747	42
818	1,983	5,916	14,997	1,537	1,015	613	2,757	43
	1	3						44
	1	3						45
	1	3						46
	1	3						47
	1	3						48
	1	3						49
	1	3						50
	1	3						51
	1	3						52
	1	3						53
	1	3						54
	1	3						55
			28	24	6		2	56
			28	23	6		1	57
			28	28	6		6	58
			28	26	8		10	59
			30	24	9		6	60
			33	28	7		5	61
			36	22	7		9	62
			36	17	8		9	63
			34	17	7		4	64
			31	18	6		2	65
			29	18	7		3	66
			31	19	7		3	67
$191,355	$308,332	$1,812,570	$4,579,941	$205,303	$175,308	$160,576	$709,464	68
	$37,400	$41,640	$147,432	$8,413				69
$12,314	$32,139	$174,775	$281,627	$22,786	$18,192	$25,683	$46,251	70
$179,041	$238,793	$1,596,155	$4,150,882	$169,031	$156,818	$134,893	$663,213	71
				$5,073	$298			72
$2,940,780	$6,373,563	$32,476,727	$86,321,875	$2,609,157	$2,717,051	$2,250,807	$9,409,330	73
440,516	1,122,754	5,266,473	12,537,891	688,807	668,168	344,127	942,093	74
$1,147,332	$3,398,229	$18,881,573	$51,563,986	$862,635	$1,228,906	$936,605	$3,483,045	75
11,641			381,699		465		417,626	76
$48,109			$2,817,839		$2,456		$1,663,701	77
74,958	27,790	328,841	1,161,063	4,986		9,409	77,839	78
$170,355	$58,306	$604,526	$2,169,422	$10,952		$20,695	$152,039	79
174,679	306,479	1,464,057	3,842,184	182,423	329,444	67,605	405,182	80
$140,246	$266,472	$1,348,409	$3,356,725	$97,887	$186,594	$50,432	$436,474	81

[2] Includes establishments distributed as follows: Colorado, 1; Connecticut, 2; Kentucky, 1; Maryland, 2; Massachusetts, 1; Minnesota, 1; Missouri, 2; West Virginia, 3.

TABLE 63.—BLAST FURNACES—DETAILED

		United States.	Alabama.	Georgia.	Illinois.	Michigan.
	Materials used—Continued.					
	Fuel—					
	Anthracite coal and culm—					
82	Tons	560,637				1,955
83	Cost	$1,812,779				$4,964
	Bituminous coal, used raw, and slack—					
84	Tons	801,640	117,154		13,976	446
85	Cost	$1,340,997	$154,991		$25,560	$1,114
	Coke—					
86	Short tons	19,739,671	2,402,082	68,514	1,925,578	33,667
87	Cost	$57,126,997	$5,904,058	$194,320	$7,871,710	$84,058
	Charcoal—					
88	Bushels	37,273,569	3,299,007	3,746,757		19,809,118
89	Cost	$2,521,887	$217,540	$224,586		$1,362,330
90	Natural gas for steam raising, cost	$83,087				
91	Rent of power and heat	$2,442			$440	
92	Mill supplies	$1,476,067	$320,414	$2,575	$29,572	$30,784
93	All other materials	$2,218,049	$405,242	$18,393	$93,497	$19,950
94	Freight	$694,636	$167,722			$147,781
95	Products, aggregate value	$231,822,707	$16,645,793	$943,204	$27,330,836	$4,643,538
	Pig iron—					
96	Total tons	16,623,625	1,471,378	74,504	1,660,610	270,933
97	Total value	$228,911,116	$16,614,577	$904,950	$25,508,271	$4,630,183
	Coke and bituminous coal—					
98	Tons	14,716,115	1,441,337	43,578	1,615,522	27,041
99	Value	$198,479,409	$16,178,583	$450,242	$24,574,535	$324,492
	Mixed anthracite coal and coke—					
100	Tons	1,230,518				
101	Value	$16,831,627				
	Anthracite—					
102	Tons	30,373				
103	Value	$391,048				
	Charcoal—					
104	Tons	409,502	29,709	30,867		243,892
105	Value	$6,993,085	$432,674	$454,052		$4,305,691
	Castings produced direct from furnace—					
106	Tons	9,469	332	59	680	
107	Value	$131,700	$3,320	$656	$12,580	
	Spiegeleisen and ferromanganese—					
108	Tons	227,648			44,408	
109	Value	$6,084,247			$921,156	
110	All other products, value	$2,572,650	$31,216	$35,397	$1,822,565	$13,355
111	Amount received for custom work and repairing	$338,941		$2,857		
	Pig iron (including spiegeleisen, ferromanganese, etc.) consumed in rolling mills, steel works, or foundries controlled by the producer:					
112	Tons	9,926,545	185,309		1,423,897	38
113	Value	$138,867,586	$1,896,724		$21,965,968	$592
	Pig iron, classified by grades:					
114	Total tons	16,623,625	1,471,378	74,504	1,660,610	270,933
115	Total value	$228,911,116	$16,614,577	$904,950	$25,508,271	$4,630,183
	Bessemer—					
116	Tons	8,894,584			1,424,030	3,520
117	Value	$123,766,565			$21,948,085	$83,712
	Low-phosphorus—					
118	Tons	192,795				
119	Value	$3,111,470				
	Malleable Bessemer—					
120	Tons	316,964			31,588	5,787
121	Value	$4,322,380			$422,232	$69,444
	Basic—					
122	Tons	2,553,940	300,784		52,658	
123	Value	$35,089,846	$4,089,234		$771,489	
	Foundry—					
124	Tons	3,675,310	1,026,969	57,077	105,835	261,626
125	Value	$47,001,758	$11,082,565	$739,445	$1,415,014	$4,477,027
	Forge—					
126	Tons	601,677	115,455	8,668	1,411	
127	Value	$7,348,339	$1,106,791	$78,328	$17,715	
	White and mottled and miscellaneous grades and direct castings—					
128	Tons	108,096	28,170	8,759	680	
129	Value	$1,343,811	$335,987	$87,177	$12,580	
	Spiegeleisen—					
130	Tons	169,630			44,408	
131	Value	$3,655,449			$921,156	
	Ferromanganese—					
132	Tons	[2] 58,018				
133	Value	$2,428,798				
	Ferrosilicon—					
134	Tons	52,611				
135	Value	$842,700				
136	Pig iron, total tons	16,623,625	1,471,378	74,504	1,660,610	270,933
137	Sand cast, tons	6,078,844	1,222,337	74,445	216,312	270,933
138	Machine cast, tons	4,307,108	75,705		782,646	
139	Chill cast, tons	329,460	6,892			
140	Delivered molten to converters or furnaces, tons	5,898,744	166,112		660,972	
141	Direct castings, tons	9,469	332	59	680	
	Furnaces in active establishments:					
	Completed—					
142	Number	343	38	4	21	11
143	Daily capacity, tons	78,180	6,395	300	6,752	1,137
	Completed during the census year—					
144	Number	17				2
145	Daily capacity, tons	6,085				325
	Idle during entire year—					
146	Number	26	4			
147	Daily capacity, tons	4,296	700			
	In course of construction—					
148	Number	4				
149	Daily capacity, tons	1,375				
	Dismantled or abandoned during the year—					
150	Number	4				
151	Daily capacity, tons	1,035				

[1] The figures for the various items in this table do not agree with the corresponding figures for 1905 in all other tables, because the figures for a blast furnace in Texas, operated by a penal institution, have been excluded. This institution reported $255,382 invested as capital; 5 salaried employees who were paid $7,020; 100 wage-earners who received $13,400; miscellaneous expenses, $3,000; materials costing $25,531; and 4,669 tons of charcoal pig iron, valued at $66,419, as products. The furnace has a daily capacity of 50 tons.

SUMMARY, BY STATES: 1905[1]—Continued.

New Jersey.	New York.	Ohio.	Pennsylvania.	Tennessee.	Virginia.	Wisconsin.	All other states.	
45,909	13,535	...	498,731	...	...	...	507	82
$147,927	$57,620	...	$1,599,655	...	...	...	$2,613	83
491	21,984	197,241	300,043	27,289	14,621	9,007	99,388	84
$1,337	$45,959	$342,137	$466,806	$40,443	$34,930	$31,828	$195,892	85
314,588	700,407	3,432,965	8,713,116	533,341	467,706	177,690	970,017	86
$1,172,456	$2,263,641	$10,548,220	$22,728,319	$1,372,339	$1,176,650	$790,509	$3,020,717	87
...	2,731,514	103,813	410,610	390,000	116,814	2,787,528	3,878,408	88
...	$196,438	$6,184	$27,225	$19,500	$7,441	$199,836	$260,807	89
...	...	$47,665	$35,422	...	...	...	...	90
...	...	$2,002	...	...	...	...	...	91
$25,800	$40,876	$230,413	$697,089	$21,263	$34,205	$7,568	$35,508	92
$32,868	$46,022	$256,561	$856,966	$70,813	$45,869	$213,334	$158,534	93
$54,350	...	$209,037	$2,421	$113,325	...	...	...	94
$3,601,511	$8,634,737	$40,862,451	$107,455,267	$3,428,049	$3,343,427	$3,074,712	$11,859,182	95
262,308	609,588	2,987,787	7,729,278	303,624	279,103	189,141	785,371	96
$3,600,144	$8,411,946	$40,705,777	$107,395,757	$3,426,932	$3,333,273	$2,761,107	$11,618,199	97
156,153	543,157	2,982,020	6,432,017	300,460	278,352	156,305	740,173	98
$2,046,510	$7,383,287	$40,620,186	$87,247,988	$3,338,898	$3,315,249	$2,334,239	$10,665,200	99
94,913	35,953	...	1,097,915	...	...	...	1,737	100
$1,306,310	$540,181	...	$14,960,818	...	...	...	$24,318	101
...	...	...	30,373	...	...	...	...	102
...	...	...	$391,048	...	...	...	...	103
...	30,168	638	2,536	2,200	751	32,836	35,905	104
...	$482,292	$16,060	$74,974	$52,800	$18,024	$426,868	$729,650	105
...	310	5,129	2,941	18	...	...	...	106
...	$6,186	$69,531	$39,193	$234	...	...	...	107
11,242	...	...	163,496	946	...	...	7,556	108
$247,324	...	...	$4,681,736	$35,000	...	...	$199,031	109
$1,367	$222,791	$22,282	$45,092	$1,117	$10,154	$313,605	$53,709	110
...	...	$134,392	$14,418	...	...	...	$187,274	111
...	248,950	1,751,730	5,573,898	120	1,022	81,625	659,956	112
...	$3,410,112	$23,624,236	$77,087,537	$1,200	$21,184	$1,252,192	$9,607,841	113
262,308	609,588	2,987,787	7,729,278	303,624	279,103	189,141	785,371	114
$3,600,144	$8,411,946	$40,705,777	$107,395,757	$3,426,932	$3,333,273	$2,761,107	$11,618,199	115
...	225,414	2,120,643	4,457,613	...	...	37,311	626,053	116
...	$3,042,853	$28,806,353	$60,282,818	...	...	$578,320	$9,024,424	117
...	26,851	...	139,763	26,181	...	...	...	118
...	$423,348	...	$2,299,771	$388,351	...	...	...	119
984	34,848	127,330	12,497	...	...	35,187	68,743	120
$14,775	$471,568	$1,698,753	$168,864	...	...	$546,190	$930,554	121
112,635	4,669	206,458	1,827,121	...	25,533	...	24,082	122
$1,491,513	$57,896	$3,053,037	$24,991,886	...	$297,483	...	$337,308	123
102,339	275,104	441,227	796,740	247,368	219,322	115,198	26,505	124
$1,396,030	$3,748,643	$5,952,476	$10,623,103	$2,701,646	$2,645,262	$1,617,812	$602,735	125
32,831	34,403	66,729	313,301	24,957	3,922	...	...	126
$422,100	$528,790	$825,616	$4,067,734	$257,090	$44,175	...	...	127
2,277	8,299	8,906	15,062	4,172	30,326	1,445	...	128
$28,402	$138,848	$135,744	$195,090	$44,845	$346,353	$18,785	...	129
11,242	...	...	106,424	...	...	...	7,556	130
$247,324	...	...	$2,287,938	...	...	...	$199,031	131
...	...	...	57,072	946	...	...	...	132
...	...	...	$2,393,798	$35,000	...	...	...	133
...	...	16,494	3,685	...	...	...	32,432	134
...	...	$233,798	$84,755	...	...	...	$524,147	135
262,308	609,588	2,987,787	7,729,278	303,624	279,103	189,141	785,371	136
119,651	382,235	1,361,161	1,490,312	303,606	255,540	189,141	193,171	137
142,657	95,346	516,338	2,376,870	...	...	...	317,546	138
...	4,669	...	279,654	...	23,563	...	14,682	139
...	127,028	1,105,159	3,579,501	...	...	...	259,972	140
...	310	5,129	2,941	18	...	...	...	141
8	15	53	131	19	13	5	25	142
1,287	3,420	15,887	34,200	1,902	1,395	860	4,645	143
...	...	7	7	...	...	...	1	144
...	...	2,875	2,825	...	...	...	60	145
...	...	...	3	...	...	...	1	146
...	...	...	975	...	...	...	400	147
...	...	1	11	4	2	...	4	148
...	...	75	1,950	414	245	...	912	149
...	...	4	...	...	...	...	...	150
...	...	1,035	...	...	...	...	...	151

[2] Includes 946 tons of ferrophosphorus.

TABLE 63.—BLAST FURNACES—DETAILED

		United States.	Alabama.	Georgia.	Illinois.	Michigan.
	Power:					
152	Number of establishments reporting	189	19	4	4	11
153	Total horsepower	825,749	101,635	3,285	50,378	8,360
	Owned—					
	Engines—					
	Steam—					
154	Number	1,555	163	13	62	48
155	Horsepower	762,382	100,253	2,920	45,243	6,706
	Gas and gasoline—					
156	Number	27		2		2
157	Horsepower	3,757		40		400
	Water wheels—					
158	Number	21		1		12
159	Horsepower	680		20		385
	Electric motors—					
160	Number	1,370	15	4	142	28
161	Horsepower	52,471	587	305	4,891	860
162	Other power, horsepower	6,320	700		200	
	Rented—					
	Electric motors—					
163	Number	14	7		7	
164	Horsepower	139	95		44	
165	Furnished to other establishments, horsepower	160				

[1] The figures for the various items in this table do not agree with the corresponding figures for 1905 in all other tables, because the figures for a blast furnace in Texas, operated by a penal institution, have been excluded. This institution reported $255,382 invested as capital; 5 salaried employees who were paid $7,020; 100

TABLE 64.—BLAST FURNACES—IDLE ESTABLISHMENTS—CAPITAL,

		United States.	Alabama.	Kentucky.	Maryland.	New Jersey.
1	Number of establishments	74	9	3	1	5
2	Capital, total	$21,829,548	$2,966,458	$512,000	$176,000	$1,468,500
3	Land	$3,328,133	$542,975	$25,000	$1,000	$550,500
4	Buildings	$10,072,070	$883,520	$375,000	$150,000	$423,000
5	Machinery, tools, and implements	$5,717,941	$1,168,958	$62,000	$25,000	$350,000
6	Cash and sundries	$2,711,404	$371,005	$50,000		$145,000
7	Rented property, total	$1,007,000	$103,000	$145,000		
8	Land	$166,000	$11,000	$20,000		
9	Buildings	$671,000	$82,000	$100,000		
10	Machinery, tools, and implements	$170,000	$10,000	$25,000		
	Furnaces:					
11	Number	91	11	5	1	5
12	Daily capacity, tons	9,268	1,270	495	50	360
	Power:					
13	Number of establishments reporting	72	9	3	1	5
14	Total horsepower	89,625	11,830	4,594	50	2,643
	Owned—					
	Engines, steam—					
15	Number	250	38	7	1	15
16	Horsepower	89,465	11,830	4,594	50	2,565
	Water wheels—					
17	Number	2				
18	Horsepower	82				
	Electric motors—					
19	Number	2				2
20	Horsepower	78				78

TABLE 65.—STEEL WORKS AND ROLLING MILLS—

		United States.	Alabama.	California.	Connecticut.	Delaware.	Illinois.	Indiana.	Kentucky.
1	Number of establishments	[2] 415	10	4	7	5	23	21	8
2	Capital, total	$700,182,310	$9,718,511	$1,110,192	$8,888,583	$6,279,585	$44,275,595	$22,985,691	$4,716,080
3	Land	$59,852,769	$470,600	$238,190	$829,221	$1,176,000	$6,691,465	$1,746,411	$346,751
4	Buildings	$115,074,703	$1,073,497	$74,000	$1,977,906	$2,177,000	$5,759,389	$2,951,909	$483,587
5	Machinery, tools, and implements	$279,542,942	$6,022,293	$584,231	$3,567,617	$2,222,665	$17,135,537	$12,581,622	$2,654,664
6	Cash and sundries	$245,711,896	$2,152,121	$213,771	$2,513,839	$703,920	$14,689,204	$5,705,749	$1,231,078
7	Rented property, total	$8,948,336	$109,000				$56,500		
8	Land	$3,527,100	$18,500				$51,000		
9	Buildings	$3,391,747	$60,500				$5,500		
10	Machinery, tools, and implements	$2,029,489	$30,000						
11	Proprietors and firm members	64					3		
	Salaried officials, clerks, etc.:								
12	Total number	14,330	165	35	137	91	1,267	323	71
13	Total salaries	$17,860,495	$223,311	$53,073	$178,033	$102,952	$1,684,457	$369,962	$78,211
	Officers of corporations—								
14	Number	711	14	5	22	12	42	27	21
15	Salaries	$2,931,254	$53,102	$20,585	$82,808	$38,933	$234,565	$81,998	$32,395
	General superintendents, managers, clerks, etc.—								
16	Total number	13,619	151	30	115	79	1,225	296	50
17	Total salaries	$14,929,241	$170,209	$32,488	$95,225	$64,019	$1,449,892	$287,964	$45,816
	Men—								
18	Number	12,648	147	24	87	72	1,113	273	42
19	Salaries	$14,361,500	$167,809	$29,568	$83,071	$61,599	$1,379,071	$275,914	$43,172
	Women—								
20	Number	971	4	6	28	7	112	23	8
21	Salaries	$567,741	$2,400	$2,920	$12,154	$2,420	$70,821	$12,050	$2,644
	Wage-earners, including pieceworkers, and total wages:								
22	Greatest number employed at any one time during the year.	256,135	5,099	913	3,361	1,702	21,611	9,298	2,917
23	Least number employed at any one time during the year.	157,316	3,104	675	2,412	1,248	11,941	5,711	1,357
24	Average number	207,562	3,636	773	2,989	1,055	16,448	7,215	2,149
25	Total wages	$122,491,993	$1,508,681	$492,390	$1,586,715	$412,003	$10,070,988	$4,071,593	$1,272,114
	Men 16 years and over—								
26	Average number	204,290	3,455	759	2,910	1,028	16,196	7,156	2,107
27	Wages	$121,615,828	$1,476,337	$487,590	$1,563,707	$407,903	$9,998,908	$4,058,790	$1,265,414

[1] Includes establishments distributed as follows: Colorado, 1; Georgia, 1; Kansas, 1; Maine, 1; Oregon, 1; Rhode Island, 4; Tennessee, 2; Washington, 1.

SUMMARY, BY STATES: 1905[1]—Continued.

New Jersey.	New York.	Ohio.	Pennsylvania.	Tennessee.	Virginia.	Wisconsin.	All other states.	
5	9	33	[illegible]	13	10	4	13	152
10,755	43,614	180,671	330,062	21,083	12,465	6,151	57,290	153
26	63	280	582	111	43	36	128	154
10,645	35,880	167,665	298,567	21,009	12,465	5,875	55,154	155
	16	1	2	2			2	156
	3,200	25	72	2			18	157
			4				4	158
			145				130	159
6	89	328	661	3		23	71	160
110	4,534	12,931	25,908	72		276	1,988	161
		50	5,370					162
								163
								164
				60			100	165

wage-earners who received $13,400; miscellaneous expenses, $3,000; materials costing $25,531; and 4,669 tons of charcoal pig iron, valued at $66,419, as products. The furnace has a daily capacity of 50 tons.

EQUIPMENT AND CAPACITY, AND POWER, BY STATES: 1905.

New York.	North Carolina.	Ohio.	Oregon.	Pennsylvania.	Tennessee.	Texas.	Virginia.	Washington.	Wisconsin.	
4	2	11	1	17	3	3	13	1	1	1
$1,821,493	$186,571	$708,193	$686,403	$8,998,905	$758,000	$726,200	$2,630,825	$40,000	$150,000	2
$280,000	$17,269	$191,500	$148,449	$1,033,240	$213,000	$95,500	$215,700	$10,000	$4,000	3
$1,170,148	$140,235	$239,000	$363,930	$4,381,014	$375,000	$231,000	$1,290,223	$10,000	$40,000	4
$225,000	$29,067	$276,657	$174,024	$2,285,633	$170,000	$217,700	$707,902	$20,000	$6,000	5
$146,345		$1,036		$1,299,018		$182,000	$417,000		$100,000	6
$90,000		$419,000		$250,000						7
$25,000		$104,000		$6,000						8
$60,000		$229,000		$200,000						9
$5,000		$86,000		$44,000						10
7	2	12	1	26	3	3	13	1	1	11
520	62	847	50	3,645	450	160	1,224	35	100	12
4	2	11	1	16	2	3	13	1	1	13
8,650	474	11,735	760	32,269	2,940	1,600	11,230	150	700	14
23	2	27	5	77	8	8	35	2	2	15
8,650	467	11,735	760	32,269	2,940	1,600	11,155	150	700	16
	1						1			17
	7						75			18
										19
										20

DETAILED SUMMARY, BY STATES: 1905.

Maryland.	Massachusetts.	Michigan.	Missouri.	New Jersey.	New York.	Ohio.	Pennsylvania.	Virginia.	West Virginia.	Wisconsin.	All other states.[1]	
7	5	5	4	16	20	57	186	3	12	10	12	1
$4,111,185	$14,348,448	$1,697,571	$3,672,268	$46,280,626	$48,852,365	$87,406,064	$355,592,456	$2,112,686	$8,716,170	$3,489,544	$25,928,090	2
$35,400	$597,885	$159,100	$236,445	$4,525,683	$2,786,183	$7,305,011	$29,685,311	$910,634	$768,000	$551,528	$792,951	3
$676,081	$1,359,162	$205,000	$447,233	$5,135,750	$12,824,687	$13,895,429	$58,327,930	$194,247	$1,933,342	$456,521	$5,122,033	4
$1,776,938	$6,829,951	$581,409	$2,070,769	$13,717,359	$22,990,395	$42,696,146	$123,912,761	$288,582	$3,077,142	$1,237,194	$15,595,667	5
$1,622,766	$5,561,450	$752,062	$917,821	$22,901,834	$10,251,100	$23,509,478	$143,666,454	$719,223	$2,937,686	$1,244,301	$4,418,039	6
$595,000				$100,000	$500		$7,641,386	$10,000		$98,950	$337,000	7
$198,000				$75,000	$500		$2,991,950	$10,000		$56,150	$126,000	8
$397,000				$25,000			$2,805,947			$42,800	$55,000	9
							$1,843,489				$156,000	10
4				1	7		49					11
117	395	38	61	566	609	1,744	8,129	37	107	133	305	12
$138,727	$364,585	$46,104	$88,798	$804,772	$801,337	$1,931,037	$10,057,776	$66,806	$142,342	$155,870	$572,342	13
8	8	3	7	35	42	57	339	8	17	9	35	14
$22,290	$15,550	$6,400	$27,420	$136,194	$228,482	$175,903	$1,520,295	$21,240	$35,913	$28,181	$169,000	15
109	387	35	54	531	567	1,687	7,790	29	90	124	270	16
$116,437	$349,035	$39,704	$61,378	$668,578	$572,855	$1,755,134	$8,537,481	$45,566	$106,429	$127,689	$403,342	17
108	373	30	51	480	520	1,587	7,269	29	83	120	240	18
$115,537	$343,172	$36,887	$59,278	$632,019	$545,361	$1,706,925	$8,226,636	$45,566	$103,462	$125,843	$380,610	19
1	14	5	3	51	47	100	521		7	4	30	20
$900	$5,863	$2,817	$2,100	$36,559	$27,494	$48,209	$310,845		$2,967	$1,846	$22,732	21
1,880	5,261	1,664	1,919	10,019	9,234	34,882	132,930	1,233	5,496	2,314	4,402	22
984	3,714	464	907	7,352	5,472	19,418	85,814	732	2,723	1,830	1,458	23
1,534	4,544	1,018	1,349	8,334	7,526	27,756	110,904	1,022	4,409	1,915	2,986	24
$811,128	$2,593,235	$526,565	$928,303	$4,087,977	$4,893,222	$18,657,542	$65,306,427	$381,715	$2,813,319	$1,124,529	$1,453,547	25
1,444	4,411	1,018	1,345	7,947	7,448	27,480	109,391	1,019	4,325	1,913	2,938	26
$793,528	$2,536,075	$526,565	$927,403	$3,967,243	$4,370,821	$18,577,904	$64,927,930	$381,168	$2,780,487	$1,123,999	$1,444,056	27

[1] Includes 6 forges and bloomeries distributed as follows: Maryland, 1; Pennsylvania, 5.

TABLE 65.—STEEL WORKS AND ROLLING MILLS—

		United States.	Alabama.	California.	Connecticut.	Delaware.	Illinois.	Indiana.	Kentucky.
	Wage-earners, including pieceworkers, and total wages—Continued.								
	Women 16 years and over—								
28	Average number	1,451		4	70		239	56	7
29	Wages	$441,013		$2,000	$20,800		$69,346	$12,203	$1,800
	Children under 16 years—								
30	Average number	1,821	181	10	9	27	13	3	35
31	Wages	$435,152	$32,344	$2,800	$2,208	$4,100	$2,734	$600	$4,900
	Average number of wage-earners, including pieceworkers, employed during each month:								
	Men 16 years and over—								
32	January	187,948	2,846	733	2,594	1,381	12,352	7,905	2,629
33	February	201,809	3,622	761	2,540	1,389	16,146	7,685	2,512
34	March	211,829	3,314	783	2,822	1,475	18,101	8,419	2,131
35	April	216,337	3,518	762	2,855	1,540	18,125	8,339	2,285
36	May	216,923	3,324	749	2,814	1,535	17,736	8,356	2,361
37	June	208,966	3,157	787	2,989	1,379	17,039	7,329	2,313
38	July	187,476	3,035	787	3,180	1,246	15,965	5,776	1,098
39	August	193,050	3,177	751	2,890	775	15,366	6,142	1,503
40	September	197,246	3,196	798	3,100	403	15,196	6,310	1,985
41	October	205,441	3,734	764	2,927	401	16,281	6,260	2,296
42	November	208,931	4,235	721	3,119	397	16,069	6,194	2,044
43	December	215,524	4,302	712	3,090	415	15,976	7,157	2,127
	Women 16 years and over—								
44	January	1,530		4	69		223	66	49
45	February	1,532		4	68		233	72	35
46	March	1,432		4	52		240	66	
47	April	1,433		5	54		243	65	
48	May	1,426		4	50		233	61	
49	June	1,460		4	85		233	52	
50	July	1,373		4	84		226	48	
51	August	1,368		4	80		233	49	
52	September	1,398		4	80		237	48	
53	October	1,398		4	76		249	49	
54	November	1,472		4	74		248	49	
55	December	1,590		3	68		270	47	
	Children under 16 years—								
56	January	1,741	182	7	9	53	12	3	41
57	February	1,795	200	8	8	55	13	3	31
58	March	1,793	187	8	7	50	16	3	6
59	April	1,875	190	9	7	55	17	3	16
60	May	1,830	167	9	7	56	17	3	25
61	June	1,878	172	8	11	30	9	3	62
62	July	1,677	170	14	11	25	8	3	62
63	August	1,752	176	10	10		14	3	20
64	September	1,781	170	13	10		11	3	15
65	October	1,877	173	15	10		13	3	62
66	November	1,896	185	12	9		14	3	50
67	December	1,907	200	7	9		12	3	30
68	Miscellaneous expenses, total	$37,373,831	$344,837	$84,933	$470,393	$144,785	$3,382,006	$606,398	$244,871
69	Rent of works	$519,722	$4,058			$420	$8,205		
70	Taxes	$2,096,368	$22,105	$5,902	$16,685	$10,594	$212,670	$44,780	$17,793
71	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$34,642,178	$318,674	$67,031	$453,708	$133,771	$3,156,831	$541,789	$227,078
72	Contract work	$115,563		$12,000			$4,300	$19,829	
73	Materials used, total cost	$441,204,432	$5,035,190	$778,970	$2,626,931	$939,506	$38,649,762	$10,905,822	$4,216,751
	Iron ore—								
	Domestic—								
74	Tons	546,262	7,273		651	844	7,311	12,792	1,803
75	Cost	$2,372,739	$34,046		$3,785	$3,801	$38,051	$45,770	$8,261
	Foreign—								
76	Tons	3,733							
77	Cost	$24,053							
	Pig iron, spiegeleisen, ferromanganese, and all other pig iron—								
78	Tons	12,191,228	236,469	610	32,017	3,962	1,446,299	74,208	103,004
79	Cost	$172,101,436	$2,582,662	$15,263	$515,208	$56,899	$19,282,069	$1,106,183	$1,393,951
	Old iron or steel rails, and other scrap iron and steel, not including that consumed in Bessemer converters or open-hearth furnaces—								
80	Tons	1,616,068	13,126	27,866	23,061	21,933	164,927	226,548	33,788
81	Cost	$21,977,102	$165,338	$397,693	$274,732	$249,289	$2,249,757	$2,776,496	$428,926
	Scrap iron and scrap steel (cast or wrought)—								
	Used in standard or modified Bessemer converters—								
82	Tons	534,916					99,418		
83	Cost	$6,290,542					$1,081,684		
	Used in acid open-hearth steel furnaces—								
84	Tons	562,963		564	655		18,041	2,941	
85	Cost	$8,617,039		$4,235	$23,820		$340,586	$34,218	
	Used in basic open-hearth steel furnaces—								
86	Tons	2,410,330	7,274		25,368		217,147	43,346	
87	Cost	$30,716,565	$93,651		$298,099		$2,530,365	$458,802	
	Purchased hammered iron-ore blooms, pig or scrap blooms, and imported Swedish billets and bars—								
88	Tons	81,969	29			25		48,291	3,000
89	Cost	$1,781,126	$581			$750		$854,786	$60,000
	Purchased muck or scrap bar—								
90	Tons	205,951			500		443	6,347	
91	Cost	$5,066,732			$17,500		$10,137	$138,922	
	Purchased iron or steel skelp—								
92	Tons	259,643							
93	Cost	$7,331,935							
	Purchased iron or steel ingots, blooms, billets, tin-plate bars, sheet bars, or slabs, except imported Swedish billets and bars—								
94	Tons	4,632,257	51,150	10,000	29,734	12,641	220,129	132,229	28,123
95	Cost	$103,420,970	$1,027,711	$257,513	$732,367	$306,578	$5,332,908	$3,180,469	$988,113
	Purchased wire rods—								
96	Tons	161,914					6,312	357	14,834
97	Cost	$4,774,383					$195,672	$11,067	$396,892
	All other iron or steel—								
98	Tons	105,662					23,878	5,146	
99	Cost	$4,377,163					$933,909	$159,364	

DETAILED SUMMARY, BY STATES: 1905—Continued.

Maryland.	Massachusetts.	Michigan.	Missouri.	New Jersey.	New York.	Ohio.	Pennsylvania.	Virginia.	West Virginia.	Wisconsin.	All other states.	
15	114			387	78	204	277					28
$3,965	$51,858			$120,734	$22,401	$59,357	$76,549					29
75	19		4			72	1,236	3	84	2	48	30
$13,635	$5,302		$900			$20,281	$301,948	$547	$32,832	$530	$9,491	31
1,581	4,672	871	1,100	8,104	7,628	24,533	101,194	839	2,995	1,971	2,020	32
1,543	4,723	896	1,273	7,916	7,530	27,027	107,507	932	3,458	2,002	2,347	33
1,481	4,765	884	1,361	7,941	8,019	29,177	111,652	992	3,797	2,101	2,614	34
1,480	4,592	913	1,310	8,078	7,877	29,903	114,198	944	4,361	2,141	3,116	35
1,542	4,515	1,403	1,380	8,274	7,581	29,870	114,587	1,126	4,586	2,034	3,150	36
1,551	4,165	1,331	1,371	8,131	7,672	27,691	111,158	1,058	4,672	2,017	3,156	37
1,292	3,653	1,137	1,122	7,817	6,395	23,370	101,641	940	4,275	1,744	3,003	38
1,245	3,827	1,242	1,090	7,773	6,426	25,226	105,679	977	4,409	1,695	2,857	39
1,421	4,066	908	1,403	7,718	6,747	26,743	107,240	1,077	4,581	1,631	2,663	40
1,425	4,290	1,005	1,622	7,653	7,659	27,570	110,615	1,146	4,717	1,658	3,418	41
1,279	4,647	862	1,566	7,369	7,804	28,260	112,569	1,138	5,030	1,751	3,377	42
1,488	5,017	704	1,542	8,090	8,038	30,390	114,652	1,059	5,019	2,211	3,535	43
13	106			376	74	226	324					44
11	114			409	75	211	300					45
11	119			391	75	211	263					46
19	120			376	75	214	262					47
21	119			370	75	217	276					48
20	117			388	75	220	266					49
18	119			395	75	183	221					50
15	104			401	72	183	227					51
15	104			385	72	177	276					52
12	104			382	73	174	275					53
14	109			380	88	217	289					54
11	133			391	107	215	345					55
69	13		2			103	1,156	3	52	1	35	56
67	16		3			96	1,183	3	62	1	46	57
53	14		4			96	1,223	3	70	1	52	58
72	17		2			87	1,254	3	87	1	55	59
83	18		5			83	1,259	3	92	1	52	60
97	19		5			77	1,228	3	103	2	49	61
96	19		4			39	1,086	3	98	3	41	62
92	21		4			39	1,217	3	101	3	39	63
78	23		5			49	1,275	3	86	3	37	64
70	24		5			66	1,291	3	81	3	58	65
62	24		4			57	1,321	3	92	3	57	66
61	20		5			72	1,339	3	89	2	55	67
$284,926	$717,910	$163,103	$172,013	$1,448,560	$1,137,066	$4,113,201	$21,924,663	$110,426	$492,683	$277,330	$1,253,727	68
$44,304	$10,710	$6,150		$7,457	$12,973	$180	$401,985	$3,060		$5,020	$15,200	69
$10,335	$83,419	$14,220	$17,952	$64,686	$88,138	$361,858	$896,279	$11,787	$24,486	$32,183	$160,496	70
$230,287	$623,781	$82,511	$154,061	$1,376,417	$1,035,955	$3,744,181	$20,614,169	$95,579	$468,197	$240,127	$1,078,031	71
		$60,222				$6,982	$12,230					72
$6,582,085	$6,901,763	$1,800,179	$1,588,494	$12,389,675	$13,260,039	$78,209,770	$237,875,025	$821,788	$8,742,471	$4,501,159	$5,379,052	73
1,275	3,670			5,150	33,358	48,239	419,503	652	1,855	150	1,736	74
$7,331	$6,132			$24,404	$110,282	$211,533	$1,860,761	$3,547	$8,346	$1,038	$5,651	75
				7		41	3,685					76
				$112		$743	$23,198					77
343,424	37,807	3,450	7,500	42,497	506,902	2,393,614	6,559,417	8,276	239,862	3,627	148,283	78
$5,045,144	$635,486	$72,420	$112,334	$751,980	$6,800,549	$33,040,901	$94,997,864	$116,130	$3,335,635	$83,518	$2,157,240	79
32,000	13,748	23,000	67,685	23,651	76,216	224,040	474,298	28,104	3,033	78,765	60,279	80
$456,042	$186,879	$454,074	$845,286	$376,564	$1,114,062	$2,950,764	$6,524,973	$529,411	$42,674	$1,144,288	$809,854	81
8,192				3,529	32,554	136,205	227,859		18,843		8,316	82
$109,610				$35,789	$431,237	$1,667,667	$2,709,622		$155,143		$99,790	83
	15,656			12,888		40,833	463,960			4,123	3,302	84
	$245,213			$221,770		$536,630	$7,094,833			$59,600	$56,134	85
7,335	41,894		500	25,137	48,215	234,889	1,705,702				53,523	86
$88,008	$476,118		$7,816	$290,523	$636,135	$2,912,834	$22,244,963				$679,251	87
	132			3,210	379		23,242			3,652	9	88
	$5,476			$65,100	$31,615		$674,443			$87,655	$720	89
				9,195	2,922	15,000	171,471		61		12	90
				$179,318	$111,874	$300,090	$4,307,001		$1,530		$360	91
		173				10,192	249,278					92
		$10,904				$315,343	$7,005,688					93
10,042	42,249	37,416	12,735	82,171	21,510	1,044,744	2,540,033	2,933	207,986	132,968	13,464	94
$251,050	$1,025,792	$1,095,973	$324,750	$2,478,191	$533,506	$23,307,225	$55,371,727	$74,017	$4,114,141	$2,687,757	$331,182	95
	871			19,764		92,246	27,530					96
	$35,346			$771,983		$2,563,171	$800,252					97
						31,509	45,329					98
						$1,395,142	$1,888,748					99

TABLE 65.—STEEL WORKS AND ROLLING MILLS—

		United States.	Alabama.	California.	Connecticut.	Delaware.	Illinois.	Indiana.	Kentucky.
	Material used—Continued.								
	Fuel—								
	Anthracite coal and culm—								
100	Tons	231,125	......	......	25,938	1,444	1,002	......	......
101	Cost	$792,262	......	......	$102,125	$5,262	$4,068	......	......
	Bituminous coal and slack—								
102	Tons	7,055,093	167,747	119	38,978	30,304	1,101,073	347,352	186,633
103	Cost	$14,367,934	$254,697	$428	$131,020	$93,468	$2,036,615	$810,017	$287,185
	Coke—								
104	Short tons	638,776	539	660	218	1,646	73,401	130	13,634
105	Cost	$2,009,392	$1,365	$6,600	$1,308	$6,107	$393,092	$515	$41,756
	Charcoal—								
106	Bushels	3,133,533	......	......	2,786	8,930	......	......	140,000
107	Cost	$299,138	......	......	$408	$926	......	......	$10,500
108	Natural gas used for fuel, cost	$4,382,667	......	......	......	......	......	$123,567	$24,377
	Oil used for fuel—								
109	Barrels	633,813	......	84,582	4,400	1,000	167,888	780	......
110	Cost	$908,154	......	$46,956	$7,637	$1,536	$286,926	$1,555	......
111	Fuel used for power, cost	$12,433,414	$250,001	$7,319	$159,413	$27,628	$582,981	$401,009	$19,539
112	Rent of power and heat	$193,705	......	$3,100	......	......	$4,768	......	......
113	Mill supplies	$6,182,266	$375,535	$7,057	$51,178	$10,166	$353,943	$168,347	$35,085
114	All other materials	$30,257,520	$216,951	$22,806	$278,921	$171,294	$2,988,585	$532,606	$491,150
115	Freight	$526,195	$32,652	$10,000	$29,410	$5,802	$3,646	$102,129	$31,016
116	Products, aggregate value	$673,965,026	$8,041,566	$1,489,012	$5,150,675	$1,597,309	$60,021,925	$16,920,326	$6,167,542
	Rolled, forged, and other classified products—								
117	Total tons	18,216,639	265,202	31,045	93,181	31,851	1,657,885	446,458	169,466
118	Total value	$584,299,439	$7,840,061	$1,115,101	$4,085,473	$1,408,456	$52,809,666	$15,430,164	$5,901,428
	Iron and steel scrap sold—								
119	Tons	877,177	3,000	......	......	2,193	64,910	14,539	2,270
120	Value	$11,079,831	$30,000	......	......	$25,623	$782,196	$157,181	$23,982
121	Amount received for custom work and repairing on rolled, forged, and other classified products.	$58,137,817	$150,000	$142,711	$747,279	$83,841	$5,117,240	$1,295,082	$235,307
122	Miscellaneous products, not rolled, including amount received for custom work and repairing.	$20,447,939	$21,505	$231,200	$317,923	$79,389	$1,312,823	$37,899	$6,825
	Equipment and capacity of active establishments:								
	Rolling mills—								
123	Total daily capacity, double turn, of rolled iron and steel, tons.	105,591	1,810	167	1,005	260	10,117	2,302	1,150
	Bessemer or modified Bessemer steel converters—								
124	Number	81	1	......	......	3	6	......	2
125	Total daily capacity of ingots or castings, double turn, tons.	41,448	500	......	......	30	5,600	......	500
	Open-hearth steel furnaces—								
126	Total number	481	18	1	6	5	37	9	......
127	Total daily capacity of ingots or castings, double turn, tons.	34,243	1,390	20	370	460	2,121	484	......
	Acid furnaces—								
128	Number	142	......	1	3	1	5	5	......
129	Daily capacity, double turn, tons	7,341	......	20	140	100	237	84	......
	Basic furnaces—								
130	Number	339	18	......	3	4	32	4	......
131	Daily capacity, double turn, tons	26,902	1,390	......	230	360	1,884	400	......
	Crucible steel furnaces—								
132	Crucible steel melting furnaces, number	146	......	......	1	......	......	......	......
133	Crucible steel pots that can be used at a heat, number.	2,457	......	......	24	......	......	......	......
134	Total daily capacity of ingots or castings, double turn, tons.	693	......	......	7	......	......	......	......
	Blister, German, and miscellaneous steel furnaces—								
135	Cementing, converting, or other furnaces, number	36	......	......	......	......	8	1	......
136	Total daily capacity of blister, German, and miscellaneous steel, double turn, tons.	98	......	......	......	......	12	7	......
	Power:								
137	Number of establishments reporting	413	10	1	7	5	23	21	8
138	Total horsepower	1,896,759	61,282	2,633	18,353	10,820	134,907	49,176	27,373
	Owned—								
	Engines—								
	Steam—								
139	Number	5,746	129	15	59	54	272	197	94
140	Horsepower	1,610,612	56,757	2,438	17,795	10,310	110,105	48,104	26,965
	Gas and gasoline—								
141	Number	53	......	......	......	......	......	4	......
142	Horsepower	11,806	......	......	......	......	......	400	......
	Water wheels—								
143	Number	54	......	......	......	......	......	......	......
144	Horsepower	4,732	......	......	......	......	......	......	......
	Water motors—								
145	Number	5	......	......	......	......	......	......	......
146	Horsepower	63	......	......	......	......	......	......	......
	Electric motors—								
147	Number	12,183	116	1	33	24	1,274	46	17
148	Horsepower	247,460	4,525	15	558	510	23,599	672	408
149	Other power, horsepower	7,868	......	......	......	......	700	......	......
	Rented—								
	Electric motors—								
150	Number	501	......	12	......	......	123	......	......
151	Horsepower	6,798	......	180	......	......	503	......	......
152	Other kind, horsepower	7,420	......	......	......	......	......	......	......
153	Furnished to other establishments, horsepower	2,744	......	......	......	......	......	......	......

DETAILED SUMMARY, BY STATES: 1905—Continued.

Maryland.	Massachusetts.	Michigan.	Missouri.	New Jersey.	New York.	Ohio.	Pennsylvania.	Virginia.	West Virginia.	Wisconsin.	All other states.	
...	2,224	20	...	9,597	44,135	216	146,524	...	...	25	...	100
...	$12,658	$100	...	$39,301	$190,653	$844	$437,051	...	...	$200	...	101
29,158	89,593	41,083	55,743	221,632	124,005	861,383	3,499,237	19,846	94,032	28,417	118,758	102
$64,113	$437,285	$108,028	$161,817	$674,565	$367,494	$1,561,708	$6,850,784	$50,522	$125,146	$87,850	$265,192	103
15,905	1,716	...	...	6,068	38,490	172,660	262,748	2,066	32,967	1,867	14,061	104
$56,463	$8,767	...	...	$28,770	$123,588	$531,313	$659,624	$5,170	$91,081	$7,188	$46,685	105
114,649	70,068	...	...	802	13,246	10,540	2,770,662	...	...	1,850	...	106
$9,940	$7,875	...	...	$101	$1,844	$1,015	$266,159	...	...	$370	...	107
...	...	...	...	...	...	$652,439	$3,381,641	...	$200,643	...	...	108
1,038	10,848	...	7,048	60,620	71,780	44,398	111,279	...	...	29,872	38,280	109
$1,707	$22,926	...	$6,343	$53,479	$114,662	$67,924	$177,759	...	...	$58,386	$60,358	110
$243,140	$424,492	$27,256	$29,292	$235,400	$766,453	$2,166,350	$6,385,687	$3,080	$175,127	$184,232	$345,015	111
$2,250	...	...	...	$1,800	$12,847	$9,298	$149,693	$8,012	...	$1,937	...	112
$28,984	$109,216	$20,401	$28,227	$275,508	$140,555	$957,422	$3,284,134	$8,611	$129,621	$29,298	$168,978	113
$216,803	$3,262,102	$10,023	$72,629	$5,877,378	$1,686,073	$3,059,414	$10,573,531	$23,288	$363,318	$65,342	$345,306	114
$1,500	...	$1,000	...	$7,639	$86,610	...	$204,889	...	$66	$2,500	$7,336	115
$8,106,929	$11,947,731	$2,712,114	$2,999,438	$20,065,972	$21,227,399	$111,996,673	$363,773,577	$1,515,959	$13,454,802	$7,379,038	$9,397,039	116
315,566	143,833	55,154	70,254	161,431	569,323	3,533,426	9,825,753	33,588	384,932	198,484	229,807	117
$7,862,789	$5,416,746	$2,327,260	$2,839,487	$9,576,226	$18,216,002	$101,233,039	$320,466,565	$1,248,192	$11,243,473	$7,072,205	$8,207,106	118
17,388	4,911	1,084	...	5,149	9,415	171,175	542,257	...	36,248	2,092	546	119
$244,140	$46,215	$13,322	...	$74,901	$130,505	$2,031,598	$7,040,285	...	$445,720	$27,196	$6,967	120
...	$5,562,731	$369,091	$150,179	$4,329,975	$2,259,821	$8,385,564	$26,246,654	$229,271	$1,762,609	$37,201	$1,033,261	121
...	$922,039	$2,441	$9,772	$6,084,870	$621,071	$346,472	$10,020,073	$38,496	$3,000	$242,436	$149,705	122
2,140	1,002	465	345	1,028	3,981	19,901	52,466	399	2,221	1,358	3,474	123
3	1	2	...	6	6	12	28	...	4	3	4	124
2,200	200	18	...	45	1,310	10,830	16,909	...	1,260	38	2,008	125
2	9	...	5	13	17	42	305	...	...	3	9	126
100	590	...	160	825	965	2,922	23,115	...	...	25	696	127
...	4	...	...	4	6	9	100	...	...	3	1	128
...	180	...	...	267	226	538	5,518	...	...	25	6	129
2	5	...	5	9	11	33	205	...	...	...	8	130
100	410	...	160	558	739	2,384	17,597	...	...	...	690	131
...	...	...	...	6	13	...	96	...	...	29	1	132
...	...	...	...	218	153	...	1,978	...	...	76	8	133
...	...	...	...	47	37	...	585	...	...	15	2	134
...	8	...	...	...	1	...	18	...	...	...	...	135
...	15	...	...	...	1	...	63	...	...	...	...	136
7	5	5	4	16	20	55	186	3	12	10	12	137
18,368	32,371	4,749	5,499	35,613	100,291	341,282	949,915	2,927	34,822	12,684	53,694	138
19	92	31	22	152	171	747	3,323	7	140	35	157	139
16,135	27,705	4,630	4,412	30,641	59,764	302,757	799,323	645	34,250	10,995	46,881	140
...	...	...	1	...	10	2	36	...	...	...	...	141
...	...	...	80	...	8,300	30	2,996	...	...	...	...	142
...	10	...	...	7	5	2	7	23	...	...	...	143
...	505	...	...	760	750	185	300	2,232	...	...	...	144
...	...	...	1	...	1	3	...	...	...	...	...	145
...	...	...	50	...	1	12	...	...	...	...	...	146
74	104	4	52	214	1,185	1,743	6,788	1	46	148	313	147
2,233	4,161	119	807	3,987	30,861	37,120	129,092	50	572	1,558	6,613	148
...	...	...	150	75	15	526	6,202	...	...	...	200	149
...	...	...	...	8	30	54	268	...	...	6	...	150
...	...	...	...	150	450	652	4,732	...	...	131	...	151
...	...	...	...	...	150	...	7,270	...	...	...	...	152
...	...	...	...	...	...	390	1,207	...	...	60	1,087	153

Table 66.—STEEL WORKS AND ROLLING MILLS—IDLE ESTABLISHMENTS—

		United States.	Alabama.	Delaware.	Illinois.	Indiana.	Kentucky.	Massachusetts.
1	Number of establishments	79	2	1	2	13	1	2
2	Capital, total	$21,168,026	$155,000	$126,000	$797,675	$3,657,413	$35,000	$529,912
3	Land	$2,702,322	$60,000	$9,000	$105,300	$368,000	$5,000	$330,000
4	Buildings	$3,928,564	$22,500	$12,000	$113,700	$718,000	$10,000	$75,000
5	Machinery, tools, and implements	$13,215,373	$72,500	$100,000	$578,675	$2,506,205	$20,000	$124,912
6	Cash and sundries	$1,321,767		$5,000		$65,208		
7	Rented property, total	$79,620						
8	Land	$46,020						
9	Buildings	$11,000						
10	Machinery, tools, and implements	$22,600						
	Equipment and capacity:							
	Rolling mills—							
11	Completed, number	74	1	1	2	11		1
12	Total daily capacity, double turn, of rolled iron and steel, tons.	8,794	40	70	240	664		50
	Bessemer, or modified Bessemer steel converters—							
13	Number	11						
14	Total daily capacity of ingots, double turn, tons	2,304						
	Open-hearth steel furnaces—							
15	Total number	26	1			3	3	2
16	Total daily capacity of ingots, double turn, tons	1,059	45			140	150	15
	Acid furnaces—							
17	Number	11				1	3	2
18	Daily capacity of ingots, double turn, tons.	284				20	150	15
	Basic furnaces—							
19	Number	15	1			2		
20	Daily capacity of ingots, double turn, tons	775	45			120		
	Crucible, blister, German and miscellaneous steel furnaces—							
21	Number	28						6
22	Crucible steel pots, number	216						24
23	Total daily capacity of crucible and other ingots, double turn, tons.	42						1
	Power:							
24	Number of establishments reporting	73	2	1	2	11	1	2
25	Total horsepower	95,241	400	855	2,275	15,203	300	1,640
	Owned—							
	Engines—							
	Steam—							
26	Number	467	3	11	14	73	2	9
27	Horsepower	91,130	400	855	2,275	14,519	300	1,400
	Gas and gasoline—							
28	Number	2				2		
29	Horsepower	325				325		
	Water wheels—							
30	Number	8						
31	Horsepower	440						
	Electric motors—							
32	Number	157				31		7
33	Horsepower	3,196				359		240
34	Other kind, horsepower	150						

CAPITAL, EQUIPMENT AND CAPACITY, AND POWER, BY STATES: 1905.

Minnesota.	Missouri.	New Jersey.	New York.	Ohio.	Pennsylvania.	Virginia.	West Virginia.	Wisconsin.	Wyoming.	
1	1	2	5	10	33	1	1	3	1	1
$253,194	$132,650	$545,103	$1,210,027	$3,639,219	$8,455,867	$150,000	$36,500	$1,397,825	$46,641	2
$38,000	$65,000	$37,071	$111,000	$348,511	$1,123,680	$25,000	$2,500	$73,500	$760	3
$64,717	$35,000	$123,258	$263,000	$791,954	$1,282,396	$95,000	$4,000	$304,089	$13,950	4
$150,477	$25,000	$384,774	$836,027	$2,342,559	$4,962,077	$30,000	$30,000	$1,020,236	$31,931	5
....	$7,650	....	....	$156,195	$1,087,714	....	....	....	....	6
....	....	....	....	$3,500	$76,120	....	....	....	....	7
....	....	....	....	$3,500	$42,520	....	....	....	....	8
....	....	....	....	....	$11,000	....	....	....	....	9
....	....	....	....	....	$22,600	....	....	....	....	10
1	1	2	4	14	31	1	1	2	1	11
160	100	665	1,040	1,138	3,917	65	200	360	75	12
....	....	....	3	2	[illegible]	....	....	2	....	13
....	....	....	800	550	654	....	....	300	....	14
....	....	....	4	3	10	....	....	....	....	15
....	....	....	130	70	509	....	....	....	....	16
....	....	....	....	[illegible]	2	....	....	....	....	17
....	....	....	....	70	29	....	....	....	....	18
....	....	....	4	....	8	....	....	....	....	19
....	....	....	130	....	480	....	....	....	....	20
....	....	....	....	12	4	....	....	5	....	21
....	....	....	....	24	132	....	....	36	....	22
....	....	....	....	1	36	....	....	4	....	23
1	1	2	5	9	31	1	1	[illegible]	1	24
1,340	375	2,568	11,750	10,778	42,777	600	400	2,980	1,000	25
10	3	8	46	75	191	4	1	7	10	26
1,100	375	1,850	11,550	10,539	41,137	600	400	2,830	1,000	27
....	....	....	....	....	....	....	....	....	....	28
....	....	....	....	....	....	....	....	....	....	29
....	....	....	....	....	8	....	....	....	....	30
....	....	....	....	....	440	....	....	....	....	31
14	....	35	10	18	30	....	....	12	....	32
240	....	718	300	239	1,050	....	....	150	....	33
....	....	....	....	....	150	....	....	....	....	34

TIN AND TERNE PLATE

TIN AND TERNE PLATE.

By STORY B. LADD.

A full history of the tin and terne plate industry both abroad and in this country, with an account of the process of manufacture, appeared in the report on the industry for the Twelfth Census. Prior to 1890 the production of tin and terne plate in the United States was of slight importance. Since that date the industry has grown rapidly, as is shown by the increase in production from about 2,236,000 pounds of tin and terne plates in 1891 to over 849,000,000 pounds in 1900 and to over 1,000,000,000 pounds in 1905. As the statistics relating to the manufacture of tin and terne plate as a separate industry were first collected at the census of 1900, comparisons can only be made between 1900 and 1905.

The manufacture of black plates and the subsequent dipping of the plates to coat them with tin or terne metal are, as a rule, accomplished in one and the same establishment, without, in many cases, any distinction being made between labor and expense chargeable to the manufacture of the black plates and that pertaining to the tin and terne dipping. The industry should be treated as an entirety, but for comparative purposes it is desirable to follow the plan of presentation employed at the Twelfth Census. Moreover, as the manufacture of black plates is a rolling mill operation, it is important that the statistics relating thereto be included in those for the industry classified as "steel works and rolling mills." Therefore separate reports were requested for the black plate manufacture and for the tin and terne dipping industry. Where these reports could not be made from book accounts, an apportionment of capital, labor, and expense was accepted, the rolling mill report being credited with the black plate product at the market values and the tin and terne plate dipping report being charged with the same as material used.

In the case of rolling mills making other products than black plates it is impossible to segregate the capital, wage-earners, wages, cost of materials, etc., chargeable to the production of black plates from that pertaining to other products, and hence the statistics include all labor and expense items of such establishments, as well as the value of all products.

THE COMBINED INDUSTRY—TIN AND TERNE DIPPING AND BLACK PLATE.

Table 1 is a comparative summary of the general statistics of the active establishments engaged in the tin and terne dipping and black plate industries for the census years 1900 and 1905.

TABLE 1.—COMBINED INDUSTRY—COMPARATIVE SUMMARY, WITH PER CENT OF INCREASE: 1905 AND 1900.

	1905			1900			PER CENT OF INCREASE.		
	Total.	Tin and terne dipping industry.	Black plate industry.	Total.	Tin and terne dipping industry.	Black plate industry.	Total.	Tin and terne dipping industry.	Black plate industry.
Number of establishments	[1] 44	36	35	[1] 66	57	44	33.3	[2] 36.8	[2] 20.5
Capital	[3] $32,457,487	$10,891,239	$21,566,248	[3] $27,488,302	$6,790,047	$20,698,255	18.1	60.4	4.2
Salaried officials, clerks, etc., number	861	284	577	726	333	393	18.6	[2] 14.7	46.8
Salaries	$936,682	$309,554	$627,128	$818,015	$291,323	$526,692	14.5	6.3	19.1
Wage-earners, average number	17,164	4,847	12,317	14,826	3,671	11,155	15.8	32.0	10.4
Total wages	$10,559,723	$2,383,070	$8,176,653	$10,288,061	$1,889,917	$8,398,144	2.6	26.1	[2] 2.6
Men 16 years and over	16,379	4,212	12,167	13,798	3,014	10,784	18.7	39.7	12.8
Wages	$10,338,370	$2,193,062	$8,145,308	$9,996,839	$1,711,475	$8,285,364	3.4	28.1	[2] 1.7
Women 16 years and over	608	579	29	688	625	63	[2] 11.6	[2] 7.4	[2] 54.0
Wages	$185,371	$179,917	$5,454	$193,834	$172,568	$21,266	[2] 4.4	4.3	[2] 74.4
Children under 16 years	177	56	121	340	32	308	[2] 47.9	75.0	[2] 60.7
Wages	$35,982	$10,091	$25,891	$97,388	$5,874	$91,514	[2] 63.1	71.8	[2] 71.7
Miscellaneous expenses	$1,815,288	$389,873	$1,425,415	$505,128	$236,456	$268,672	259.4	64.9	430.5
Cost of materials used	[4] $49,016,487	$31,375,714	$17,640,773	[4] $45,004,716	$26,728,150	$18,276,566	8.9	17.4	[2] 3.5
Value of products	[4] $65,679,117	$35,283,360	$30,395,757	[4] $61,912,619	$31,892,011	$30,020,608	6.1	10.6	1.2

[1] Includes 27 establishments in 1905 and 35 in 1900 which manufactured black plates as well as tin and terne plates; 9 in 1905 and 22 in 1900 which manufactured tin and terne plates only; and 8 in 1905 and 9 in 1900 which manufactured black plates only.
[2] Decrease.
[3] Includes value of rented property—1905, $473,000; 1900, $165,000.
[4] Includes a duplication of $22,988,237 in 1905 and $20,590,566 in 1900, the value of black plates reported among the products of the black plate industry and used as material in the tin and terne dipping industry.

As a rule, black plate mills operated in conjunction with dipping establishments produce black plates only, and, with the exception of three cases, black plates constitute the chief product of the independent rolling mills making black plates.

The industry is first considered as a whole, followed by the statistics for the tin and terne dipping industry, and then by those pertaining to the manufacture of black plates. Statistics for the last are included in those for steel works and rolling mills in the report on iron and steel.

The period covered by this report is the calendar year 1904, or the business year of the establishments reporting which most nearly conforms to that year. In the census of 1900 the period covered was from June 1, 1899, to May 31, 1900. The gross ton of 2,240 pounds is used except where otherwise stated.

The establishments which manufacture black plates and also coat them are counted both in the tin and terne dipping industry and in the black plate industry, but such establishments count but one in the number of establishments for the combined industries. There were 27 such establishments in 1905 and 35 in 1900. In other words, 75 per cent of the active dipping establishments were equipped for the manufacture of black plates in 1905, as compared with 61.4 per cent in 1900.

The capital invested in the black plate industry in 1905 constituted 66.4 per cent of the total capital for the combined industries, as against 75.3 per cent in 1900. The cost of materials used as well as the value of the products include a duplication, much of the black plate product of the black plate industry being consumed as material in the tin and terne dipping industry. Thus the cost of the black plates consumed by the dipping establishments was $22,988,237 in 1905 and $20,590,566 in 1900, which leaves $26,021,949 as the approximate cost of materials used by the combined industries in 1905, as against $24,414,150 in 1900. In like manner, deducting the same duplication from the value of products, the approximate value of the products in 1905 was $42,690,880, as compared with $41,322,053 in 1900. This shows an increase of 6.6 per cent in the approximate net cost of materials and 3.3 per cent in the approximate net value of products in 1905, as compared with 1900.

Table 2 shows the capital invested in all establishments, both active and idle, and its distribution between tin and terne dipping establishments and black plate establishments in 1905 and 1900. As the statistics for establishments under construction were not collected at the census of 1905, the statistics for such establishments have been eliminated from the figures for 1900.

TABLE 2.—*Combined industry—active and idle establishments—capital, by industries: 1905 and 1900.*

INDUSTRY.	Census.	Number of establishments.	CAPITAL.			
			Total.	Land.	Buildings, machinery, tools, and implements.	Cash and sundries.
Total	1905	[1] 54	[2] $33,759,901	$1,676,980	$18,231,751	$13,851,170
	1900	[1] 68	[2] 27,515,527	1,906,125	15,097,265	10,512,137
Tin and terne	1905	[3] 41	11,339,049	403,100	5,189,297	5,746,652
	1900	59	6,817,272	539,125	2,650,540	3,627,607
Black plate	1905	41	22,420,852	1,273,880	13,042,454	8,104,518
	1900	44	20,698,255	1,367,000	12,446,725	6,884,530

[1] Includes establishments equipped as follows: 1905—28 plants for the manufacture of black plates and tin and terne plates, 13 plants for the manufacture of tin and terne plates only, and 13 plants for the manufacture of black plates only. 1900—35 plants for the manufacture of black plates and tin and terne plates, 24 plants for the manufacture of tin and terne plates only, and 9 plants for the manufacture of black plates only.
[2] Includes value of rented property—1905, $473,000; 1900, $165,000.
[3] Not including 8 establishments, 6 of which are idle and attached to rolling mills, and 2 to establishments classified as "tinware;" capital not reported separately.

The total capital shows an increase of 22.7 per cent for the period 1900 to 1905, the major part of this increase being in the tin and terne plate dipping industry, in which the capital invested increased 66.3 per cent, while the capital in the black plate industry increased but 8.3 per cent. Of the total capital, that portion invested in buildings, machinery, tools, and implements increased 20.8 per cent and that in cash and sundries, 31.8 per cent. The capital invested in land shows a decrease of 12 per cent, due probably to concentration of the industry during the period.

In 1905, 54 per cent of the total capital was in buildings, machinery, tools, and implements, as against 54.9 per cent in 1900; in the tin and terne plate industry 45.8 per cent was in buildings, machinery, tools, and implements in 1905, as against 38.9 per cent in 1900; and in the black plate industry, 58.2 per cent in 1905, as against 60.1 per cent in 1900.

Table 3 shows the combined capital by active and idle establishments in 1900 and 1905.

TABLE 3.—*Combined industry—active and idle establishments—capital: 1905 and 1900.*

	Census.	Number of establishments.	CAPITAL.			
			Total.	Land.	Buildings, machinery, tools, and implements.	Cash and sundries.
Total	1905	[1] 54	[2] $33,759,901	$1,676,980	$18,231,751	$13,851,170
	1900	68	[2] 27,515,527	1,906,125	15,097,265	10,512,137
Active	1905	44	32,457,487	1,611,380	17,049,327	13,796,780
	1900	66	27,488,302	1,895,400	15,080,765	10,512,137
Idle	1905	10	1,302,414	65,600	1,182,424	54,390
	1900	2	27,225	10,725	16,500	....

[1] Not including 8 tin and terne dipping establishments, 6 of which are idle and attached to rolling mills, and 2 to establishments classified as "tinware;" capital not reported separately.
[2] Includes value of rented property—1905, $473,000; 1900, $165,000.

Of the total amount of capital invested, less than one-tenth of 1 per cent in 1900 was in idle establishments, and in 1905 only 3.9 per cent.

Table 4 shows the capital invested, number of salaried employees and salaries paid, and the average number of wage-earners and total wages paid for the combined industries for the state of Pennsylvania and "all other states" in 1900 and 1905. On account of the control of many tin and terne dipping plants in Indiana, Ohio, and West Virginia by one company, although there are three or more plants in each of these states, the detailed statistics can not be shown separately for the combined industry, or for the tin and terne dipping industry, without disclosing the operations of individual concerns.

TABLE 4.—COMBINED INDUSTRY—COMPARATIVE SUMMARY, BY STATES: 1905 AND 1900.

STATE.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.	
				Number.	Salaries.	Average number.	Wages.
United States	1905	44	[1] $32,457,487	861	$936,682	17,164	$10,559,723
	1900	66	[1] 27,488,302	726	818,015	14,826	10,288,061
Pennsylvania	1905	19	14,942,692	546	592,466	8,511	5,249,701
	1900	30	12,517,557	342	358,566	6,017	4,349,327
All other states	[2] 1905	25	17,514,795	315	344,216	8,653	5,310,022
	[3] 1900	36	14,970,745	384	459,449	8,809	5,938,734

[1] Includes value of rented property—1905, $473,000; 1900, $165,000.
[2] Includes establishments distributed as follows: Illinois, 1; Indiana, 4; Kentucky, 1; Maryland, 2; Michigan, 1; Missouri, 1; New York, 2; Ohio, 7; West Virginia, 6.
[3] Includes establishments distributed as follows: Illinois, 5; Indiana, 5; Kentucky, 1; Maryland, 3; Michigan, 1; Missouri, 1; New York, 4; Ohio, 12; Virginia, 1; West Virginia, 3.

The cost of materials and the value of products have been omitted from this table, as it is impracticable to show these items by states without duplication; black plates produced in one state, and therefore credited to that state as products, being often consumed in other states by tin and terne dipping establishments and their value consequently reappears in the value of products of such states.

The proportional number of establishments in Pennsylvania decreased from 45.5 per cent of the total in 1900 to 43.2 per cent in 1905. All the other items show an increase proportionately—capital, from 45.5 per cent in 1900 to 46 per cent in 1905; salaried officials, from 47.1 per cent to 63.4 per cent; salaries, from 43.8 per cent to 63.3 per cent; wage-earners, from 40.6 per cent to 49.6 per cent; and wages, from 42.3 per cent to 49.7 per cent.

Table 5 is a comparative summary of the materials used by the tin and terne dipping and black plate establishments for 1900 and 1905, with the per cent of increase.

TABLE 5.—COMBINED INDUSTRY—MATERIALS USED, BY KIND, QUANTITY, AND COST, WITH PER CENT OF INCREASE: 1905 AND 1900.

KIND.	Unit of measure.	1905		1900		PER CENT OF INCREASE.	
		Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.
Aggregate			[1] $49,016,487		[1] $45,004,716		8.9
Iron ore	Tons			1,035	6,916		
Pig iron, spiegeleisen, and ferromanganese	Tons			16,514	253,920		
Old iron or steel rails and other scrap iron or steel	Tons	11,630	148,776	34,422	592,222	[2] 66.2	[2] 74.9
Iron or steel ingots, blooms, billets, tin-plate bars, sheet bars and slabs	Tons	662,887	15,440,072	648,807	13,911,080	2.2	11.0
Domestic black plates or sheets for tinning, total	Pounds	1,019,524,757	22,988,237	825,556,992	20,590,566	23.5	11.6
Bessemer steel	Pounds	911,663,989	20,734,710	(3)	(3)		
Acid open-hearth steel	Pounds	19,343,920	436,850	(3)	(3)		
Basic open-hearth steel	Pounds	87,567,481	1,789,855	(3)	(3)		
Iron	Pounds	949,367	26,822	(3)	(3)		
Foreign black plates or sheets for tinning	Pounds	83,900	3,769	2,358,607	78,282	[2] 96.4	[2] 95.2
Pig tin	Pounds	24,243,851	6,709,164	20,282,778	4,528,473	19.5	43.6
Pig lead	Pounds	8,201,253	366,558	6,871,480	398,617		
Palm oil	Pounds	6,628,526	376,310	5,511,645	282,227	20.3	33.3
Sulphuric acid and tinning flux, bran, and pink meal			180,011		187,318		[2] 3.9
Boxes and nails			504,887		303,316		66.4
Fuel, total			1,490,407		960,526		55.2
Anthracite coal	Tons	3,240	9,960	4,456	6,465		
Bituminous coal	Tons	287,969	462,293	598,113	619,245		
Coke	Short tons	858	2,397	2,962	4,628		
Charcoal	Bushels	156,800	13,325	12,926	739		
Natural gas			293,795		328,388		
Oil	Barrels	2,422	4,238	50	1,061		
Fuel for power			704,399		(3)		
All other materials			808,296		2,911,253		

[1] Includes a duplication equal to the cost of the domestic black plates, products of the black plate industry and used as material in the tin and terne dipping industry.
[2] Decrease.
[3] Not reported separately.

The tin and lead contents of terne mixture, when purchased in 1905, were entered separately at current values in the census returns for that year, but at the census of 1900 terne mixture, when purchased, was in some cases reported as "pig tin" and in other cases as "pig lead." For this reason the quantities and values of tin and lead, as reported for 1900, are not strictly comparable with those for 1905, except when combined.

The heavy increase in the quantity of domestic black plates used—an increase of 193,967,765 pounds, or 23.5 per cent—and the decrease in the quantity of foreign plates used—from 2,358,607 pounds to 83,900 pounds—are worthy of notice.

The average cost of the domestic black plates used by tin and terne plate establishments in 1905 was 2.25 cents per pound, as compared with 2.49 cents per pound in 1900; and the average value of the black plates turned out by the rolling mills in 1905 was 2.24 cents per pound, as compared with 2.38 cents per pound in 1900. The average value of the iron black plates made by rolling mills in 1905 was 1.96 cents per pound; of the Bessemer steel black plates, 2.31 cents per pound; and of the open-hearth steel black plates, 2.17 cents per pound. In 1900 there were no iron black plates reported as manufactured, and the Bessemer steel black plates were of an average value of 2.35 cents per pound and the open-hearth steel black plates 2.63 cents per pound.

Table 6 shows the value of the net products of the tin and terne plate dipping and black plate establishments for 1900 and 1905, with the per cent of increase.

Table 6.—*Combined industry—net value of products, with per cent of increase: 1905 and 1900.*

INDUSTRY.	PRODUCTS (NET VALUE). 1905	PRODUCTS (NET VALUE). 1900	Per cent of increase.
Total	$42,690,880	$41,322,053	3.3
Tin and terne dipping	35,283,360	31,892,011	10.6
Black plate[1]	7,407,520	9,430,042	[2]21.4

[1] Does not include $22,988,237 in 1905 and $20,590,566 in 1900, the value of black plates consumed by tin and terne dipping establishments.
[2] Decrease.

Duplication has been largely avoided by omitting the value of the domestic black plates consumed by the tin and terne plate dipping industry from the products of the black plate industry.

Some duplications remain, however, but they are of a minor character and the values of all products for each census year are substantially correct.

The products of the black plate industry remaining after the exclusion of the black plates consumed by tin and terne dipping establishments include the black plates otherwise used and all other products of the rolling mills making black plates. The slight increase in the value of net products of 3.3 per cent is due to the considerable decrease in the value of the excess of the products of the black plate establishments over and above the black plates consumed by tin and terne dipping establishments.

THE TIN AND TERNE DIPPING INDUSTRY.

The statistics included under this head are those for establishments which buy black plates and coat them, or for the dipping department only in the case of plants which both manufacture and dip black plates.

Table 7 is a comparative summary of the general statistics of the tin and terne dipping industry for 1900 and 1905.

Table 7.—*Tin and terne dipping industry—comparative summary, with per cent of increase: 1905 and 1900.*

	1905	1900	Per cent of increase.
Number of establishments	36	57	[1]36.8
Capital	[2]$10,891,239	[2]$6,790,047	60.4
Salaried officials, clerks, etc., number	284	333	[1]14.7
Salaries	$309,554	$291,323	6.3
Wage-earners, average number	4,847	3,671	32.0
Total wages	$2,383,070	$1,889,917	26.1
Men 16 years and over	4,212	3,014	39.7
Wages	$2,193,062	$1,711,475	28.1
Women 16 years and over	579	625	[1]7.4
Wages	$179,917	$172,568	4.3
Children under 16 years	56	32	75.0
Wages	$10,091	$5,874	71.8
Miscellaneous expenses	$389,873	$236,456	64.9
Cost of materials used	$31,375,714	$26,728,150	17.4
Value of products	$35,283,360	$31,892,011	10.6

[1] Decrease.
[2] Includes value of rented property—1905, $78,000; 1900, $140,000.

A noticeable concentration of the industry is shown in this table. Although the number of establishments decreased 36.8 per cent, the capital increased 60.4 per cent and the value of products 10.6 per cent. The advance in wages did not keep pace with the increase in wage-earners, but the amount paid for salaries showed an increase, though the number of salaried officials decreased.

Table 8 presents the statistics relating to the capital of both active and idle tin and terne dipping establishments for the censuses of 1900 and 1905.

Table 8.—*Tin and terne dipping industry—active and idle establishments—capital: 1905 and 1900.*

	Census.	Number of establishments.	CAPITAL. Total.	CAPITAL. Land.	CAPITAL. Buildings, machinery, tools, and implements.	CAPITAL. Cash and sundries.
Total	1905	[1]41	[2]$11,339,049	$403,100	$5,189,297	$5,746,652
	1900	59	[2]6,817,272	539,125	2,650,540	3,627,607
Active	1905	36	10,891,239	386,000	4,774,873	5,730,366
	1900	57	6,790,047	528,400	2,634,040	3,627,607
Idle	1905	5	447,810	17,100	414,424	16,286
	1900	2	27,225	10,725	16,500	....

[1] Not including 8 establishments, 6 of which are idle and attached to rolling mills, and 2 classified as "tinware;" capital not reported separately.
[2] Includes value of rented property—1905, $78,000; 1900, $140,000.

The increase in capital, $4,521,777, or 66.3 per cent, is in the main almost equally divided between equipment, as represented by buildings, machinery, tools, and implements, which have increased $2,538,757, and live capital, which has increased $2,119,045. In 1905 the capital invested in idle plants constituted 3.9 per cent of the total, as compared with four-tenths of 1 per cent in 1900.

Table 9 is a comparative summary of the statistics of the tin and terne dipping industry for the state of Pennsylvania and "all other states" for 1900 and 1905. As before stated, the statistics for states other than Pennsylvania can not be given separately without disclosing the operations of individual owners.

TABLE 9.—TIN AND TERNE DIPPING INDUSTRY—COMPARATIVE SUMMARY, BY STATES: 1905 AND 1900.

STATE.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
				Number.	Salaries.	Average number.	Wages.			
United States	1905	36	[1] $10,891,239	284	$309,554	4,847	$2,383,070	$389,873	$31,375,714	$35,283,360
	1900	57	[1] 6,790,047	333	291,323	3,671	1,889,917	236,456	26,728,150	31,892,011
Pennsylvania	1905	19	4,700,369	191	218,980	2,421	1,206,781	231,376	17,590,077	19,341,961
	1900	25	3,042,029	189	147,202	1,578	813,692	82,169	10,364,084	12,530,991
All other states	[2] 1905	17	6,190,870	93	90,574	2,426	1,176,289	158,497	13,785,637	15,941,399
	[3] 1900	32	3,748,018	144	144,121	2,093	1,076,225	154,287	16,364,066	19,361,020

[1] Includes value of rented property—1905, $78,000; 1900, $140,000.
[2] Includes establishments distributed as follows: Indiana, 3; Maryland, 1; Michigan, 1; Missouri, 1; New York, 2; Ohio, 5; West Virginia, 4.
[3] Includes establishments distributed as follows: Illinois, 3; Indiana, 5; Kentucky, 1; Maryland, 2; Michigan, 1; Missouri, 1; New York, 4; Ohio, 12; Virginia, 1; West Virginia, 2.

Pennsylvania advanced considerably in importance in the industry during the five-year period from 1900 to 1905, for, notwithstanding a slight decrease in proportion of the total capital invested in the industry, the proportion of the total value of product assignable to the state increased from 39.3 per cent in 1900 to 54.8 at the census of 1905, and at the latter census about one-half of all the wage-earners reported for the industry in the United States were employed in the tin and terne plate mills of Pennsylvania.

The kind, quantity, and cost of materials used in the tin and terne plate industry in 1900 and 1905 are shown in Table 10, with the percentage of increase for the different items.

TABLE 10.—TIN AND TERNE DIPPING INDUSTRY—MATERIALS USED, BY KIND, QUANTITY, AND COST, WITH PER CENT OF INCREASE: 1905 AND 1900.

KIND.	Unit of measure.	1905		1900		PER CENT OF INCREASE.	
		Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.
Aggregate			$31,375,714		$26,728,150		17.4
Domestic black plates or sheets for tinning, total	Pounds	1,019,524,757	22,988,237	825,556,992	20,590,566	23.5	11.6
Bessemer steel	Pounds	911,663,989	20,734,710	(1)	(1)		
Acid open-hearth steel	Pounds	19,343,920	436,850	(1)	(1)		
Basic open-hearth steel	Pounds	87,567,481	1,789,855	(1)	(1)		
Iron	Pounds	949,367	26,822	(1)	(1)		
Foreign black plates or sheets for tinning	Pounds	83,900	3,769	2,358,607	78,282	[2] 96.4	[2] 95.2
Pig tin	Pounds	24,243,851	6,709,164	20,282,778	4,528,473	19.5	43.6
Pig lead	Pounds	8,201,253	366,558	6,871,480	398,617		
Palm oil	Pounds	6,628,526	376,310	5,511,645	282,227	20.3	33.3
Sulphuric acid, tinning flux, bran, and pink meal			180,011		187,318		[1] 3.9
Boxes and nails			504,887		303,316		66.4
Fuel, total			159,786		91,456		74.7
Anthracite coal	Tons	3,240	9,960	4,456	6,465		
Bituminous coal	Tons	50,560	78,484	35,048	48,059		
Coke	Short tons			1,092	2,000		
Charcoal	Bushels			556	122		
Natural gas			56,998		34,110		
Oil					700		
Fuel for power			14,344		(1)		
All other material			86,992		267,895		

[1] Not reported separately.
[2] Decrease.

The total quantity of black plates consumed, both domestic and foreign, was 1,019,608,657 pounds in 1905, as against 827,915,599 pounds in 1900, an increase of 191,693,058 pounds, or 23.2 per cent. The imported black plates in 1905 constituted less than one one-hundredth of 1 per cent of the total amount used, as against a little less than three-tenths of 1 per cent in 1900. In 1905 the foreign plates were used in Penn-

sylvania, and in 1900 in Pennsylvania and Virginia. The black plates formed 73.3 per cent of the cost of all material in 1905 and 77.3 per cent in 1900.

As already explained, the quantity and cost of tin and lead in 1905 are not strictly comparable with those items in 1900, on account of the difference at the two censuses in the method of reporting terne mixture. The fuels reported by kinds are, likewise, not comparable, except for the total cost, inasmuch as fuel used for power was classified separately in 1905 and not distributed among the several kinds of fuel as in 1900. The difference between the total quantity of tin or terne plated products, shown in Table 11, and the quantities of black plates, pig tin, and pig lead used, indicates a loss of 1.9 per cent in the process of tin and terne dipping.

Table 11 shows the quantity and value of the products of the tin and terne dipping establishments for the state of Pennsylvania and "all other states" for 1900 and 1905.

TABLE 11.—TIN AND TERNE DIPPING INDUSTRY—COMPARATIVE SUMMARY OF PRODUCTS, BY STATES: 1905 AND 1900.

STATE.	Census.	Total value.	TIN PLATES.		TERNE PLATES.		OTHER SHEET IRON AND SHEET STEEL, TIN OR TERNE PLATED.		All other products, including amount received for custom work and repairing.
			Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	
United States	1905	$35,283,360	867,526,985	$28,429,971	158,857,866	$6,119,572	6,555,855	$217,476	$516,341
	1900	31,892,011	707,718,239	25,553,021	141,285,783	5,731,124	1,000,473	86,492	521,374
Pennsylvania	1905	19,341,961	524,905,922	16,547,120	58,693,218	2,381,277	6,555,855	217,476	196,088
	1900	12,530,991	256,879,332	9,137,483	77,129,648	3,263,769	200,473	6,492	123,247
All other states	[1] 1905	15,941,399	342,621,063	11,882,851	100,164,648	3,738,295			320,253
	[2] 1900	19,361,020	450,838,907	16,415,538	64,156,135	2,467,355	800,000	80,000	398,127

[1] Includes establishments distributed as follows: Indiana, 3; Maryland, 1; Michigan, 1; Missouri, 1; New York, 2; Ohio, 5; West Virginia, 4.
[2] Includes establishments distributed as follows: Illinois, 3; Indiana, 5; Kentucky, 1; Maryland, 2; Michigan, 1; Missouri, 1; New York, 4; Ohio, 12; Virginia, 1; West Virginia, 2.

The total production in 1905 was 1,032,940,706 pounds of tin and terne plates or sheets of all kinds, valued at $34,767,019, as against 850,004,495 pounds, valued at $31,370,637, in 1900, an increase of 182,936,211 pounds in quantity, or 21.5 per cent, and of $3,396,382 in value, or 10.8 per cent.

In 1905 tin plates constituted 84 per cent in quantity of the tin or terne plated output; terne plates, 15.4 per cent; and other sheet iron and sheet steel, tin or terne plated, six-tenths of 1 per cent, as against 83.3 per cent for tin plates, 16.6 per cent for terne plates, and one-tenth of 1 per cent for other tin or terne plated iron and steel sheets in 1900.

The average value of tin plate was 3.28 cents per pound, as against 3.61 cents in 1900; the average value of the terne plates was 3.85 cents per pound, as against 4.06 cents in 1900; and the average value of other sheet iron and sheet steel, tin or terne plated, was 3.32 cents per pound, as against 8.65 cents in 1900.

There has been a heavy increase in tin plate production in Pennsylvania during the period, amounting to 268,026,590 pounds, or 104.3 per cent. The state produced 60.5 per cent of the total tin plate product of the country in 1905, as against 36.3 per cent in 1900.

Table 12 shows for tin plates, terne plates, taggers tin, etc., the total domestic production and consumption, the imports, the exports of domestic and of foreign origin, and the percentage of the domestic consumption supplied by imported plates, for the quinquennial periods from 1890 to 1905.

TABLE 12.—TIN PLATE, TERNE PLATE, AND TAGGERS TIN PRODUCED, IMPORTED, EXPORTED, AND RETAINED FOR CONSUMPTION: 1890 TO 1905.[1]

YEAR.	Production (pounds).	Exports of domestic (pounds).	Domestic retained for consumption (pounds).	Imports (pounds).	Exports of foreign (pounds).	Total retained for consumption (pounds).	Per cent of imports to total consumption.
1905	[2] 1,032,940,706	22,990,816	1,009,949,890	161,066,820	180,550	1,170,836,160	13.7
1900	[2] 850,004,495	319,579	849,684,916	147,963,804	850,228	996,798,492	14.8
1895	193,800,320		193,800,320	508,038,938	468,249	701,371,009	72.4
1890	(3)			680,060,925	1,550,229	678,510,696	100.0

[1] Bureau of Statistics, Department of Commerce and Labor, "Statistical Abstract of the United States," 1905.
[2] Production according to Census returns.
[3] Not reported separately.

The tin plate industry was of very small proportions in the United States in 1890; very few tin and terne plates were made for sale, and the market was practically supplied by imports. The establishment of the industry dates from 1891, when the output was about 2,236,000 pounds. The first export of domestic plates was made in 1898, the amount being 20,827 pounds; in 1900 the amount had increased to 319,579 pounds, while in 1905 it was 22,990,816 pounds, a gain for the last five years of more than seventyfold. The net amount retained for consumption increased for the five-year period 1900 to 1905, 174,037,668 pounds, or 17.5 per cent, and the domestic production increased 182,936,211 pounds, or 21.5 per cent.

Table 13 shows the equipment of all tin and terne dipping establishments, whether active or idle, and the daily capacity of the plants in pounds of tin and terne plates, on single turn, for the years 1900 and 1905.

TABLE 13.—TIN AND TERNE DIPPING INDUSTRY—ACTIVE AND IDLE ESTABLISHMENTS—NUMBER, EQUIPMENT, AND DAILY CAPACITY, BY STATES: 1905 AND 1900.

STATE.	Census.	Number of establishments.	NUMBER OF SETS. Total.	NUMBER OF SETS. Employed on— Tin plates.	NUMBER OF SETS. Employed on— Terne plates.	DAILY CAPACITY, IN POUNDS, SINGLE TURN. Total.	DAILY CAPACITY, IN POUNDS, SINGLE TURN. Tin plates.	DAILY CAPACITY, IN POUNDS, SINGLE TURN. Terne plates.
United States	1905	[1] 49	685	544	141	4,504,949	3,754,099	750,85[illegible]
	1900	59	585	(2)	(2)	2,759,901	2,018,538	741,36[illegible]
Illinois	1905	2	21	21	....	193,000	193,000	....
	1900	3	30	30	....	142,000	142,000	....
Indiana	1905	4	92	82	10	764,700	657,900	106,80[illegible]
	1900	5	84	(2)	(2)	452,000	380,050	71,95[illegible]
Kentucky	1905	1	4	1	3	24,666	6,166	18,50[illegible]
	1900	1	4	(2)	(2)	10,600	5,300	5,30[illegible]
Maryland	1905	1	16	16	....	100,000	100,000	....
	1900	2	21	21	....	120,000	120,000	....
Michigan	1905	1	2	2	....	3,000	3,000	....
	1900	1	4	4	....	3,000	3,000	....
Missouri	1905	1	16	16	....	35,000	35,000	....
	1900	1	15	15	....	100,000	100,000	....
New York	1905	2	11	3	8	24,800	4,800	20,000
	1900	4	13	(2)	(2)	47,800	27,800	20,000
Ohio	1905	9	118	77	41	703,433	562,000	141,433
	1900	13	103	(2)	(2)	500,500	358,500	142,000
Pennsylvania	1905	[3] 21	328	269	59	2,168,417	1,799,800	368,617
	1900	26	285	(2)	(2)	1,220,001	806,888	413,113
Virginia	1905	1	3	1	2	18,000	6,000	12,000
	1900	1	3	(2)	(2)	10,000	....	10,000
West Virginia	1905	6	74	56	18	469,933	386,433	83,500
	1900	2	23	(2)	(2)	154,000	75,000	79,000

[1] Includes 8 establishments and equipments not included in other tables, of which 6 are idle and attached to rolling mills and 2 to establishments classified as "tinware," distributed as follows: Indiana, 1; Illinois, 2; Kentucky, 1; Pennsylvania, 2; Virginia, 1; WestVirginia, 1.
[2] Not reported separately.
[3] Includes 6 plants reported as 3 establishments.

There is included in the above table the equipment of 8 establishments which do not figure in the other tables. Of these, 6 are idle tin or terne dipping plants attached to rolling mills and 2 are dipping plants in establishments making tinware and so classified. There are 24 plants in Pennsylvania, although only 21 are credited to this state, 6 plants having been covered by three reports in making the returns for 1905. Hence in the aggregate there are 52 completed tin and terne dipping plants in 1905, as against 59 in 1900.

On the basis of three hundred working days for the year the tin and terne plate product for 1905 was 76 per cent of the capacity of all establishments on single turn; the output of tin plates being 77 per cent of the annual capacity and the terne plate product, 70.5 per cent.

The majority of the active establishments operated in 1905 on double turn. There were 8 establishments on single turn, which as a rule is ten hours; 21 on double turn; 7 on triple turn, eight hours to a crew; and 5 establishments were idle during the year. There were 23 establishments equipped for the manufacture of both tin and terne plates, 20 establishments for the manufacture of tin plates only, and 6 for the manufacture of terne plates only. Thus 43 plants had tin plate and 29 terne plate equipments. In 1900, of the 59 active and idle plants, 35 were equipped for the manufacture of both tin and terne plates, 15 for the manufacture of tin plates only, and 9 terne plates only; or 50 for the manufacture of tin plates and 44 for the manufacture of terne plates.

A detailed summary of the statistics of the active establishments is presented for Pennsylvania and "all

other states" in Table 20 at the end of this report. The table does not include the statistics of 2 dipping equipments in Illinois attached to establishments making tinware and so classified.

The statistics for the 5 idle tin and terne dipping establishments for which reports are available are shown in Table 21 at the end of this report. Four of these establishments are located in Ohio and 1 in West Virginia. This table is exclusive of 6 idle dipping plants attached to rolling mills, where a separation of capital has not been made. Of these establishments, 1 is in Indiana, 1 in Kentucky, 2 in Pennsylvania, 1 in Virginia, and 1 in West Virginia.

THE BLACK PLATE INDUSTRY.

Black plates or sheets for tinning are a product of the rolling mill, and the statistics therefor are included in those for steel works and rolling mills in the report on the iron and steel industry. The following statistics are those of the rolling mills which make black plates or sheets for tinning, either solely or in connection with other rolling mill products.

Table 14 is a comparative summary of the statistics of the black plate industry for 1900 and 1905.

TABLE 14.—*Black plate industry—comparative summary, with per cent of increase: 1905 and 1900.*

	1905	1900	Per cent of increase.
Number of establishments	35	44	[1] 20.5
Capital	[2] $21,566,248	[2] $20,698,255	4.2
Salaried officials, clerks, etc., number	577	393	46.8
Salaries	$627,128	$526,692	19.1
Wage-earners, average number	12,317	11,155	10.4
Total wages	$8,176,653	$8,398,144	[1] 2.6
Men 16 years and over	12,167	10,784	12.8
Wages	$8,145,308	$8,285,364	[1] 1.7
Women 16 years and over	29	63	[1] 54.0
Wages	$5,454	$21,266	[1] 74.4
Children under 16 years	121	308	[1] 60.7
Wages	$25,891	$91,514	[1] 71.7
Miscellaneous expenses	$1,425,415	$268,672	430.5
Cost of materials used	$17,640,773	$18,276,566	[1] 3.5
Value of products	$30,395,757	$30,020,608	1.2
Black plates	$25,297,079	$20,967,805	20.6
All other products	$5,098,678	$9,052,803	[1] 43.7

[1] Decrease.
[2] Includes value of rented property—1905, $395,000; 1900, $25,000.

The products of this industry include at the census of 1905 black plates valued at $25,297,079, or 83.2 per cent of all products, and in 1900 black plates valued at $20,967,805, or 69.8 per cent of all products. "All other products" in 1900 included plates and sheets other than black plates having a value of $4,517,644, and in 1905 there is included in "all other products" boiler and other plates and sheets having a value of $3,941,563 and scrap sold amounting to $1,041,949.

There was a decrease in the number of establishments making black plates in 1905 as compared with 1900, but the total products in 1905 show a small increase over the products in 1900, and the black plate product shows a very material increase, the percentage of increase being 20.6.

The proportionate increase in miscellaneous expenses is apparently very large, but the amount reported for miscellaneous expenses by rolling mills making black plates in 1900 constituted but 1 per cent of the total expense; whereas in the industry as a whole—"steel works and rolling mills"—miscellaneous expenses constituted 4.7 per cent of all expenses reported. In 1905 miscellaneous expenses as reported by the black plate rolling mills is 5.1 per cent of all expense, as compared with 6 per cent for all steel works and rolling mills.

The statistics of capital invested in the active and idle black plate establishments in 1900 and 1905 are presented in detail in Table 15.

TABLE 15.—*Black plate industry—active and idle establishments—capital: 1905 and 1900.*

CLASS.	Census.	Number of establishments.	CAPITAL. Total.	Land.	Buildings, machinery, tools, and implements.	Cash and sundries.
Total	1905	41	[1] $22,420,852	$1,273,880	$13,042,454	$8,104,518
	1900	44	[1] 20,698,255	1,367,000	12,446,725	6,884,530
Active	1905	35	21,566,248	1,225,380	12,274,454	8,066,414
	1900	44	20,698,255	1,367,000	12,446,725	6,884,530
Idle	1905	6	854,604	48,500	768,000	38,104
	1900	.....	.....	.....	.....	.....

[1] Includes value of rented property—1905, $395,000; 1900, $25,000.

The increase from 1900 to 1905 in the amount of capital invested in these establishments was not large—only 8.3 per cent. The part invested in land decreased, while that invested in equipment increased only 4.8 per cent. The capital invested in idle establishments, nearly 90 per cent of which was in the form of equipment, amounted to only 3.8 per cent of the total.

Table 16 presents the statistics of the industry for Pennsylvania and "all other states" for 1900 and 1905.

TABLE 16.—BLACK PLATE INDUSTRY—COMPARATIVE SUMMARY, BY STATES: 1905 AND 1900.

STATE.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
				Number.	Salaries.	Average number.	Wages.			
United States	1905	35	[1] $21,566,248	577	$627,128	12,317	$8,176,653	$1,425,415	$17,640,773	$30,395,757
	1900	44	[1] 20,698,255	393	526,692	11,155	8,398,144	268,672	18,276,566	30,020,608
Pennsylvania	1905	16	10,242,323	355	373,486	6,090	4,042,920	732,745	9,059,252	15,679,736
	1900	22	9,475,528	153	211,364	4,439	3,535,635	66,948	6,708,650	11,147,659
All other states	[2] 1905	19	11,323,925	222	253,642	6,227	4,133,733	692,670	8,581,521	14,716,021
	[3] 1900	22	11,222,727	240	315,328	6,716	4,862,509	201,724	11,567,916	18,872,949

[1] Includes value of rented property—1905, $395,000; 1900, $25,000.
[2] Includes establishments distributed as follows: Illinois, 1; Indiana, 4; Kentucky, 1; Maryland, 1; Ohio, 7; West Virginia, 5.
[3] Includes establishments distributed as follows: Illinois, 3; Indiana, 5; Kentucky, 1; Maryland, 1; Missouri, 1; Ohio, 9; West Virginia, 2.

In the black plate as well as in the other branch of the industry, Pennsylvania is much the most important state, reporting 47.5 per cent of the total capital, 50 per cent of the total number of salaried officials, clerks, and wage-earners, and 51.6 per cent of the total value of products. Within the state itself the number of establishments decreased, but all the other items showed considerable increases.

The cost of materials used in the manufacture of black plates in 1900 and 1905 is shown in Table 17.

TABLE 17.—BLACK PLATE INDUSTRY—MATERIALS USED, BY KIND, QUANTITY, AND COST, WITH PER CENT OF INCREASE: 1905 AND 1900.

KIND.	Unit of measure.	1905		1900		PER CENT OF INCREASE.	
		Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.
Aggregate			$17,640,773		$18,276,566		[1] 3.5
Iron ore	Tons			1,035	6,916		
Pig iron, spiegeleisen and ferromanganese	Tons			16,514	253,920		
Old iron or steel rails and other scrap iron or steel	Tons	11,630	148,776	34,422	592,222	[1] 66.2	[1] 74.9
Iron or steel ingots, blooms, billets, tin-plate bars, sheet bars and slabs	Tons	662,887	15,440,072	648,807	13,911,080	2.2	11.0
Fuel, total			1,330,621		869,070		53.1
Bituminous coal and slack	Tons	237,409	383,809	563,065	571,186		
Coke	Short tons	858	2,397	1,870	2,628		
Charcoal	Bushels	156,800	13,325	12,370	617		
Natural gas			236,797		294,278		
Oil	Barrels	2,422	4,238	50	361		
Fuel for power			690,055		(2)		
All other materials			721,304		2,643,358		

[1] Decrease.
[2] Not reported separately.

Although, as has been shown, the value of products increased slightly from 1900 to 1905, the total cost of materials decreased 3.5 per cent. In 1905 no iron ore or pig iron, etc., was reported as purchased, and the amount of iron or steel scrap used decreased largely. For the census of 1905 the cost of fuel used for power was reported separately, amounting to $690,055, but the kinds and quantities of fuel so used were not stated. Hence a comparison with 1900 can only be made as to the total expenditures for fuel, which amounted to $1,330,621 in 1905 and to $869,070 in 1900. Natural gas was used as fuel in whole or in part by 18 establishments, of which 2 were located in Indiana, 3 in Ohio, 10 in Pennsylvania, and 3 in West Virginia.

Table 18 shows in detail the products of the black plate industry for Pennsylvania and "all other states" for 1900 and 1905.

TABLE 18.—BLACK PLATE INDUSTRY—COMPARATIVE SUMMARY OF PRODUCTS, BY STATES: 1905 AND 1900.

	Census.	Total value.	BLACK PLATES.								ALL OTHER PLATES AND SHEETS.		All other products.
			Total.		Iron.		Bessemer steel.		Open-hearth steel.				
			Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	
United States	1905	$30,395,757	504,025	$25,297,079	64,111	$2,809,936	353,027	$18,271,625	86,887	$4,215,518	77,867	$3,941,563	$1,157,115
	1900	30,020,608	394,014	20,967,805			355,077	18,673,311	38,937	2,294,494	79,096	4,517,644	4,535,159
Pennsylvania	1905	15,679,736	266,068	13,552,164	34,665	1,505,020	213,904	11,141,073	17,499	906,071	27,831	1,448,033	679,539
	1900	11,147,659	178,574	9,423,900			169,464	9,012,437	9,110	411,463	23,547	1,296,279	427,480
All other states	[1] 1905	14,716,021	237,957	11,744,915	29,446	1,304,916	139,123	7,130,552	69,388	3,309,447	50,036	2,493,530	477,576
	[2] 1900	18,872,949	215,440	11,543,905			185,613	9,660,874	29,827	1,883,031	55,549	3,221,365	4,107,679

[1] Includes establishments distributed as follows: Illinois, 1; Indiana, 4; Kentucky, 1; Maryland, 1; Ohio, 7; West Virginia, 5.
[2] Includes establishments distributed as follows: Illinois, 3; Indiana, 5; Kentucky, 1; Maryland, 1; Missouri, 1; Ohio, 9; West Virginia, 2.

In 1900 no iron black plates were reported, and nine-tenths of the black plates were made of Bessemer steel and one-tenth of open-hearth steel. In 1905, 70 per cent of these plates were made of Bessemer steel, 17.2 per cent of open-hearth steel, and 12.7 per cent of iron. The black plates show an increase in 1905, as compared with 1900, of 27.9 per cent in quantity and 20.6 per cent in value. The average value of all kinds of black plates in 1905 was $50.19 per ton, as compared with $53.22 per ton in 1900. The iron black plates show an average value of $43.83 per ton; Bessemer steel, $51.76 per ton; and open-hearth steel, $48.52 per ton. In 1900 the average value of the Bessemer black plates was $52.59 per ton, and of the open-hearth steel black plates $58.93 per ton. There is included in the "value of all other products" the billets, tin-plate bars, and sheet bars produced for sale by the rolling mills making black plates, valued at $53,230 in 1905, also iron and steel scrap sold having a value of $1,041,949. In 1900 the billets and sheet and tin-plate bars included in "all other products" amounted to $1,894,000.

The black plate product of the state of Pennsylvania increased 49 per cent in 1905, as compared with 1900, and this state contributed 52.8 per cent of all black plates manufactured in the country in 1905, as against 45.3 per cent in 1900.

Table 19 shows the hot and cold mill equipment, by states, of the active and idle rolling mill establishments producing black plates, and the annual capacity of the hot mills, for 1900 and 1905.

TABLE 19.—*Black plate industry—active and idle establishments—number, equipment, and capacity, by states: 1905 and 1900.*

STATE.	Census.	Number of establishments.	Number of hot mills.	Number of cold mills.	Annual capacity of hot mills (tons).
United States	1905	41	406	334	958,455
	1900	44	332	294	641,450
Ohio	1905	9	81	71	183,581
	1900	8	59	58	114,525
Pennsylvania	1905	17	209	173	491,408
	1900	23	160	157	314,325
West Virginia	1905	5	43	33	105,098
	1900	2	14	14	27,250
All other states	[1] 1905	10	73	57	178,368
	[2] 1900	11	99	65	185,350

[1] Includes establishments distributed as follows: Illinois, 1; Indiana, 6; Kentucky, 1; Maryland, 1; Wisconsin, 1.
[2] Includes establishments distributed as follows: Illinois, 3; Indiana, 5; Kentucky, 1; Maryland, 1; Missouri, 1.

The above table includes completed mills only. There has been an increase in each state for which details are given in numbers of hot and cold mills, and in the annual capacity of the hot mills. In 1905 the black plate product equaled 52.6 per cent of the capacity of the hot plate mills, as compared with 61.4 per cent in 1900.

TABLE 20.—*Tin and terne plate—detailed summary, by states: 1905.*

	United States.	Pennsylvania.	All other states.[1]
Number of establishments	36	19	17
Capital, total	$10,813,239	$4,692,369	$6,120,870
Land	$310,000	$221,000	$89,006
Buildings	$1,859,927	$384,000	$1,475,927
Machinery, tools, and implements	$2,912,946	$1,046,500	$1,866,446
Cash and sundries	$5,730,366	$3,040,869	$2,689,497
Value of rented property	$78,000	$8,000	$70,000
Proprietors and firm members	1	1	....
Salaried officials, clerks, etc.:			
Total number	284	191	93
Total salaries	$309,554	$218,980	$90,574
Officers of corporations—			
Number	21	15	6
Salaries	$67,450	$57,750	$9,700
General superintendents, managers, clerks, etc.—			
Total number	263	176	87
Total salaries	$242,104	$161,230	$80,874
Men—			
Number	232	152	80
Salaries	$232,788	$154,234	$78,554
Women—			
Number	31	24	7
Salaries	$9,316	$6,996	$2,320
Wage-earners, including pieceworkers, and total wages:			
Greatest number employed at any one time during the year	6,161	3,121	3,040
Least number employed at any one time during the year	3,741	1,877	1,864
Average number	4,847	2,421	2,426
Total wages	$2,383,070	$1,206,781	$1,176,289
Men 16 years and over—			
Average number	4,212	2,096	2,116
Wages	$2,193,062	$1,112,001	$1,081,061
Women 16 years and over—			
Average number	579	305	274
Wages	$179,917	$91,289	$88,628
Children under 16 years—			
Average number	56	20	36
Wages	$10,091	$3,491	$6,600
Average number of wage-earners, including pieceworkers, employed during each month:			
Men 16 years and over—			
January	3,715	1,743	1,972
February	3,997	1,895	2,102
March	4,216	1,972	2,244
April	4,279	2,192	2,087
May	4,545	2,341	2,204
June	4,737	2,484	2,253
July	4,647	2,418	2,229
August	4,379	2,211	2,168
September	3,894	1,896	1,998
October	3,947	1,953	1,994
November	3,653	1,746	1,907
December	4,535	2,301	2,234
Women 16 years and over—			
January	541	266	275
February	589	278	311
March	617	289	328
April	572	309	263
May	626	337	289
June	698	377	321
July	670	357	313
August	618	328	290
September	497	280	217
October	490	286	204
November	466	262	204
December	564	291	273
Children under 16 years—			
January	36	5	31
February	48	16	32
March	56	23	33
April	58	23	35
May	69	31	38
June	64	25	39
July	61	23	38
August	65	23	42
September	53	15	38
October	55	17	38
November	51	16	35
December	56	23	33
Miscellaneous expenses, total	$389,873	$231,376	$158,497
Rent of works	$2,615	$1,350	$1,265
Taxes	$28,267	$16,104	$12,163
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$358,991	$213,922	$145,069

[1] Includes establishments distributed as follows: Indiana, 3; Maryland, 1; Michigan, 1; Missouri, 1; New York, 2; Ohio, 5; West Virginia, 4.

TABLE 20.—*Tin and terne plate—detailed summary, by states: 1905*—Continued.

	United States.	Pennsylvania.	All other states.
Materials used, aggregate cost	$31,375,714	$17,590,077	$13,785,637
Black plates or sheets for tinning—			
Total pounds	1,019,608,657	566,744,792	452,863,865
Total cost	$22,992,006	$12,934,377	$10,057,629
Domestic—			
Total pounds	1,019,524,757	566,660,892	452,863,865
Total cost	$22,988,237	$12,930,608	$10,057,629
Bessemer steel—			
Pounds	911,663,989	528,914,790	382,749,199
Cost	$20,734,710	$12,056,046	$8,678,664
Acid open-hearth steel—			
Pounds	19,343,920	13,038,320	6,305,600
Cost	$436,850	$296,870	$139,980
Basic open-hearth steel—			
Pounds	87,567,481	23,758,415	63,809,066
Cost	$1,789,855	$550,870	$1,238,985
Iron—			
Pounds	949,367	949,367	....
Cost	$26,822	$26,822	....
Foreign (iron)—			
Pounds	83,900	83,900	....
Cost	$3,769	$3,769	....
Pig tin—			
Pounds	24,243,851	13,796,949	10,446,902
Cost	$6,709,164	$3,800,156	$2,909,008
Pig lead—			
Pounds	8,201,253	3,012,247	5,189,006
Cost	$366,558	$132,935	$233,623
Palm oil—			
Pounds	6,628,526	3,582,475	3,046,051
Cost	$376,310	$202,321	$173,989
Sulphuric acid, tinning flux, bran and pink meal, etc	$180,011	$106,311	$73,700
Boxes and nails	$504,887	$291,458	$213,429
Fuel, total cost	$159,786	$73,376	$86,410
Anthracite coal and culm—			
Tons	3,240	3,120	120
Cost	$9,960	$9,360	$600
Bituminous coal and slack—			
Tons	50,560	19,562	30,998
Cost	$78,484	$28,959	$49,525
Natural gas	$56,998	$28,414	$28,584
Fuel used for power	$14,344	$6,643	$7,701
Mill supplies	$30,755	$15,333	$15,422
All other materials	$56,237	$33,810	$22,427
Products, total value	$35,283,360	$19,341,961	$15,941,399
Tin plates—			
Pounds	867,526,985	524,905,922	342,621,063
Value	$28,429,971	$16,547,120	$11,882,851
Terne plates—			
Pounds	158,857,866	58,693,218	100,164,648
Value	$6,119,572	$2,381,277	$3,738,295
Other sheet iron or sheet steel, tinned or terne plated, taggers tin, tinned stamped ware, etc.—			
Pounds	6,555,855	6,555,855	....
Value	$217,476	$217,476	....
All other products, including tin dross, scruff, scrap, etc.—			
Pounds	23,377,952	4,620,450	18,757,502
Value	$516,341	$196,088	$320,253
Equipment of tin plate and terne plate department:			
Number of completed tin or terne sets in works	598	321	277
Equipment of tin plate and terne plate department—Continued.			
Number of sets usually employed in coating tin plates	478	266	212
Number of sets usually employed in coating terne plates	120	55	65
Capacity of plant—			
Daily capacity of tinning department for producing bright tin plates, single turn, pounds	3,221,500	1,772,300	1,449,200
Daily capacity of works for producing terne plates, single turn, pounds	625,050	335,317	289,733
Black plate department of tin plate and terne plate establishments (not including detached black plate mills):			
Number of completed hot plate mills	315	196	119
Annual capacity of completed mills in finished black plates, in gross tons, on triple turn	707,405	462,208	245,197
Number of completed cold plate mills	272	164	108
Power:			
Number of establishments reporting power	20	12	8
Total horsepower	9,231	5,896	3,335
Owned—			
Engines—			
Steam—			
Number	39	31	8
Horsepower	8,878	5,793	3,085
Gas and gasoline—			
Number	1	....	1
Horsepower	50	....	50
Electric motors—			
Number	18	7	11
Horsepower	241	91	150
Rented—			
Electric motors—			
Number	3	3	....
Horsepower	12	12	....
Other kind, horsepower	50	....	50

TABLE 21.—*Tin and terne plate—idle establishments—capital, capacity, and power: 1905.*

Number of establishments	[1]5
Capital, total	$447,810
Land	$17,100
Buildings	$122,510
Machinery, tools, and implements	$291,914
Cash and sundries	$16,286
Daily capacity of plants, single turn:	
Tin plates, pounds	45,000
Terne plates, pounds	42,000
Power:	
Number of establishments reporting	3
Total horsepower owned	2,500
Engines, steam—	
Number	4
Horsepower	2,500

[1] Ohio, 4; West Virginia, 1.

COPPER, LEAD, AND ZINC, SMELTING AND REFINING

COPPER, LEAD, AND ZINC, SMELTING AND REFINING.

By Story B. Ladd.

The smelting and refining of ores was first treated as manufacturing at the census of 1870. Prior thereto the statistics for mining and the milling and smelting and refining of ores were combined, and no segregation was made of the statistics relating to mining and milling and those bearing on the manufacturing side of the industry. At the census of 1870 a separation of the industry was made, and the treatment of the ores after delivery from the mines was classed as manufacturing, but at the census of 1890 smelting and refining was reported as an adjunct to the mining industry, and no attempt was made to secure data in harmony with the returns secured from manufacturing establishments. Under the act of Congress for taking the Twelfth and subsequent censuses the smelting and refining of ores is considered a manufacturing industry, and a full presentation of the statistics for lead, copper, and zinc smelting and refining was made at the Twelfth Census.

It is possible to present statistics for the present census comparable with those of 1900, but not with those for censuses prior thereto.

Copper and lead ores constitute the medium through which the precious metals contained in the bulk of the dry ores reach the refineries. Copper and lead ores not only often carry gold and silver values, but gold and silver ores deficient in base metal, or "dry ores," so called, are smelted with lead or copper ores to facilitate the extraction of the precious metals from the dry ores. Hence the gold and silver products are relatively large and in the case of the argentiferous lead smelters they exceed the base metal values.

In order to show the total quantities and cost of ore and matte or crude metal treated and of finished products manufactured, the ores and matte or crude metal smelted and refined under contract are reported, both as to quantities and cost of materials and value of products, as if bought by the reporting establishments, and in addition the amounts received for contract smelting or refining are reported.

With the exception of the smelting of nickel, tungsten, and molybdenum ores, and the few products of electric smelting, the statistics herewith presented cover all data relating to the smelting of ores and the refining of the products, with the exception of those relating to iron, which will be found in the special report on iron and steel.

The period covered by this report is the calendar year 1904, or the business year of the establishment reporting which most nearly conforms thereto. At the census of 1900 the period covered was from June 1, 1899 to May 31, 1900. The short ton is used unless otherwise stated.

THE COMBINED INDUSTRY.

Table 1 is a summary of the leading statistics of the copper, lead, and zinc smelting and refining industries for 1900 and 1905, showing the combined totals and the per cent of increase for the five-year period for the combined industry and the several sections.

Table 1.—COPPER, LEAD, AND ZINC, SMELTING AND REFINING—COMPARATIVE SUMMARY, BY INDUSTRIES, WITH PER CENT OF INCREASE: 1905 AND 1900.

	TOTAL.		COPPER.		LEAD.		ZINC.		PER CENT OF INCREASE.			
	1905	1900	1905	1900	1905	1900	1905	1900	Total.	Copper.	Lead.	Zinc.
Number of establishments	103	117	40	47	32	39	31	31	[1] 12.0	[1] 14.9	[1] 17.9	......
Capital	$164,349,036	$139,354,138	$76,824,640	$53,063,395	$63,822,810	$72,148,933	$23,701,586	$14,141,810	17.9	44.8	[1] 11.5	67.6
Salaried officials, clerks, etc., number	1,687	1,121	809	488	524	425	354	208	50.5	65.8	23.3	70.2
Salaries	$2,996,463	$2,150,018	$1,527,382	$954,905	$887,602	$754,913	$581,479	$440,200	39.4	60.0	17.6	32.1
Wage-earners, average number	26,853	24,512	12,752	11,324	7,573	8,319	6,528	4,869	9.6	12.6	[1] 9.0	34.1
Total wages	$20,058,200	$15,973,626	$10,827,043	$8,529,021	$5,374,691	$5,088,684	$3,856,466	$2,355,921	25.6	26.9	5.6	63.7
Men 16 years and over	26,774	24,427	12,702	11,272	7,566	8,312	6,506	4,843	9.6	12.7	[1] 9.0	34.3
Wages	$20,030,593	$15,944,937	$10,808,442	$8,509,895	$5,371,031	$5,086,704	$3,851,120	$2,348,338	25.6	27.0	5.6	64.0
Women 16 years and over	9	12	....	4	7	....	2	8	[1] 25.0	....	......	[1] 75.0
Wages	$4,284	$5,869	....	$2,500	$3,660	....	$624	$3,369	[1] 27.0	....	......	[1] 81.5
Children under 16 years	70	73	50	48	....	7	20	18	[1] 4.1	4.2	......	11.1
Wages	$23,323	$22,820	$18,601	$16,626	....	$1,980	$4,722	$4,214	2.2	11.9	......	12.1
Miscellaneous expenses	$6,972,896	$3,088,007	$4,748,399	$1,522,325	$897,876	$1,166,210	$1,326,621	$399,472	125.8	211.9	[1] 23.0	232.1
Cost of materials used	$382,723,480	$279,655,350	$196,736,986	$122,174,129	$168,958,076	$144,195,163	$17,028,418	$13,286,058	36.8	61.0	17.2	28.2
Value of products	$451,398,354	$358,786,472	$240,780,216	$165,131,670	$185,826,839	$175,466,304	$24,791,299	$18,188,498	25.8	45.8	5.9	36.3

[1] Decrease.

At the census of 1900 the lead smelting and refining industry was in the van, and copper occupied second place, but the positions have since been reversed.

The increase in capital in both the copper and zinc

industries is large, and proportionately the greater in the latter, whereas in the lead industry there is shown a decrease. The same holds true of the average number of wage-earners employed, the copper and zinc industries showing increased numbers, the largest increase being in the zinc industry, whereas the lead industry shows a decrease. With respect to the value of products both the actual and proportionate increase was greatest in the copper industry.

The following tabular statement shows the per cent of the total capital, wage-earners, and value of products, represented by the copper, lead, and zinc industries, for 1900 and 1905:

INDUSTRY.	1905			1900		
	Capital	Wage-earners.	Value of products.	Capital.	Wage-earners	Value of products.
Total	100.0	100.0	100.0	100.0	100.0	100.0
Copper	46.8	47.5	53.3	38.1	46.2	46.0
Lead	38.8	28.2	41.2	51.8	33.9	48.9
Zinc	14.4	24.3	5.5	10.1	19.9	5.1

The statistics for the zinc smelting industry show the straight growth of that industry. The statistics for the copper and lead smelting industries are, however, colored by the practice of smelting dry ores of the precious metals along with these base ores, and a large increase in the consumption of dry ores by copper smelters at the expense of the lead smelters has helped to swell the growth of the copper smelting and refining industry.

This is shown by the following statement, which gives the gold and silver production of the copper smelting and refining, and lead smelting and refining industries, for the censuses of 1900 and 1905, and shows also the copper product of the former industry, exclusive of Lake copper, and the lead product of the latter industry, exclusive of soft lead, which exclusions are made for the reason that dry ores, so called, are not smelted in conjunction with Lake copper ores or "mineral," or soft lead ores. The statement also gives the increase of the several products for the period 1900 to 1905, and the per cent of increase:

Copper and lead, smelting and refining—quantity of principal products, with amount and per cent of increase: 1905 and 1900.

KIND.	QUANTITY.				INCREASE.		PER CENT OF INCREASE.	
	Copper smelting and refining.		Lead smelting and refining.		Copper smelting and refining.	Lead smelting and refining.	Copper smelting and refining.	Lead smelting and refining.
	1905	1900	1905 [1]	1900				
Silver, ounces fine	28,115,790	13,229,911	71,920,997	70,420,917	14,885,879	1,500,080	112.5	2.1
Gold, ounces fine	636,207	224,352	2,543,757	2,514,836	411,855	28,921	183.6	1.2
Copper, not including Lake copper, pounds	728,620,468	444,654,289			283,966,179		63.9	
Lead, not including soft lead, pounds			613,331,956	497,455,931		115,876,025		23.3

[1] Duplication on account of Doré bars reported both as materials and products deducted; contents of same 671,990 ounces of silver, 30,792 ounces of gold.

It will be seen that the increase in the gold and silver products of the copper smelting and refining industry was very large and greatly in excess of the increase in the related copper product, although the latter increase is in itself large, 63.9 per cent; whereas the gains in the gold and silver products of the lead smelting and refining industry are very small and fall far below that for the related lead product.

The following statement further illustrates the change in smelting conditions and shows the total gold and silver production of the copper and lead smelters and refineries for 1900 and 1905 and the per cent of the total contributed by each class:

INDUSTRY.	SILVER (OUNCES FINE).		GOLD (OUNCES FINE).		PER CENT OF TOTAL.			
					Silver.		Gold.	
	1905	1900	1905	1900	1905	1900	1905	1900
Total	100,036,787	83,650,828	3,179,964	2,739,188	100.0	100.0	100.0	100.0
Copper smelting and refining	28,115,790	13,229,911	636,207	224,352	28.1	15.8	20.0	8.2
Lead smelting and refining	71,920,997	70,420,917	2,543,757	2,514,836	71.9	84.2	80.0	91.8

The silver output of the lead refineries shows a decrease from 84.2 per cent of the total silver product of the copper and lead refineries in 1900 to 71.9 per cent of the total for 1905, and a decrease in the gold output for the same period from 91.8 per cent to 80 per cent; while on the other hand the copper refineries show very heavy proportional gains in both silver and gold.

The increase in the consumption of dry ores by copper smelters appears to be due in part to the development of electrolytic copper refining whereby gold and silver values are easily and cheaply recovered, and also to the fact that, in the rapid advance in the art of matte smelting, copper has proved to be on the whole a better absorbent of the precious metals than lead.

COPPER SMELTING AND REFINING.

The general statistics of the copper smelting industry are shown in Table 2 for 1905 in comparison with like statistics for 1900.

TABLE 2.—*Copper smelting and refining—comparative summary, with per cent of increase: 1905 and 1900.*

	CENSUS.		Per cent of increase.
	1905	1900	
Number of establishments	40	47	[1]14.9
Capital	$76,824,640	$53,063,395	44.8
Salaried officials, clerks, etc., number	809	488	65.8
Salaries	$1,527,382	$954,905	60.0
Wage-earners, average number	12,752	11,324	12.6
Total wages	$10,827,043	$8,529,021	26.9
Men 16 years and over	12,702	11,272	12.7
Wages	$10,808,442	$8,509,895	27.0
Women 16 years and over		4	
Wages		$2,500	
Children under 16 years	50	48	4.2
Wages	$18,601	$16,626	11.9
Miscellaneous expenses	$4,748,399	$1,522,325	211.9
Cost of materials used	$196,736,986	$122,174,129	61.0
Value of products	$240,780,216	$165,131,670	45.8

[1] Decrease.

In addition to the active establishments shown in Table 2, there were 6 idle establishments reported at the census of 1905, located 1 each in Alaska, California, Colorado, Georgia, Montana, and Utah. The statistics are as follows:

TABLE 3.—*Copper smelting and refining—idle establishments: 1905.*

Number of establishments	6
Capital, total	$3,461,991
Land	$103,085
Buildings	$713,462
Machinery, tools, and implements	$663,976
Cash and sundries	$1,981,468
Power owned:	
Number of establishments reporting	5
Total horsepower	4,052
Engines—	
Steam—	
Number	15
Horsepower	3,060
Gas and gasoline—	
Number	3
Horsepower	128
Water wheels—	
Number	4
Horsepower	425
Water motors—	
Number	1
Horsepower	8
Electric motors—	
Number	17
Horsepower	431

At the census of 1900 there were 9 idle establishments with a capital of $371,320, located as follows: Arizona, 4; California, 1; Illinois, 1; and Nevada, 3.

The value of products as given in Table 2 is the aggregate of the products of all establishments, the smelters as well as the refineries, and such establishments as do both smelting and refining, and hence includes the duplication arising from the products of the smelters which appear as material for the refineries. The products of the refineries, or smelters combined with refineries, represent the finished products, the same including the product of the Lake ores.

The totals for the copper smelting industry as reported at the census of 1890 (Report on Mineral Industries), though too meager for comparison with later years, are given in Table 4.

TABLE 4.—*Copper smelting and refining: 1890.*

Capital, total	$4,037,593
Land	634,000
Buildings and fixtures	1,758,856
Tools, implements, etc	600,214
Cash, etc	1,044,523
Expenditures, total	1,885,261
Wages	800,484
Salaries	71,720
Paid contractors	19,591
Supplies and materials	737,098
Rent, interest, insurance, taxes, etc	256,368

In the absence of other statistics, the copper production can be taken as a gauge of the growth of the industry, and Table 5 shows the copper production from 1845 to 1904, inclusive.

The copper product of the United States for 1904, which is the year covered by the census of 1905, as reported to the United States Geological Survey, was 362,739 long tons. This includes the copper contents of blue vitriol and the copper product of lead smelters.

The refined copper product as reported at this census was 933,809,701 pounds, which is the copper product of the refineries and of the refineries combined with the smelters. (See Table 12.) There is included in this, however, a duplication of 23,829,109 pounds on account of material which, after treatment at some of the refineries, was sent for final treatment to others. To arrive at the copper product of the United States there is to be added the copper contents of the blue vitriol manufactured, estimated at one-fourth for copper contents, or 6,932,475 pounds; also the exports of copper in the form of matte, namely, 29,346,550 pounds, and further, there is to be deducted 91,743,719 pounds of refined copper produced from imported ore, matte, and pig copper. This gives 854,515,898 pounds as the product from mines located in the United States, or 381,480 long tons. Total quantity of Lake copper produced was 205,189,233 pounds.

The production of the smelters not connected with refineries contained 620,872,420 pounds of fine copper. This amount includes a duplication of 17,634,605 pounds, which represents the copper contents of matte shipped from certain of the smelters to others within the same class. After this duplication is eliminated the total product of the detached smelters contained 603,237,815 pounds of fine copper.

TABLE 5.—*Production of copper in the United States: 1845 to 1904.* [1]

YEAR.	Total (long tons).	LAKE SUPERIOR.		MONTANA.		ARIZONA.		ALL OTHER.	
		Quantity (long tons).	Per cent of total.	Quantity (long tons).	Per cent of total.	Quantity (long tons).	Per cent of total.	Quantity (long tons).	Per cent of total.
1904	362,739	92,995	25.6	133,168	36.7	85,537	23.6	51,039	14.1
1903	311,627	85,893	27.6	121,677	39.0	65,914	21.2	38,143	12.2
1902	294,423	76,165	25.9	128,975	43.8	53,547	18.2	35,736	12.1
1901	268,782	69,772	26.0	102,621	38.2	58,383	21.7	38,006	14.1
1900	270,588	64,938	24.0	120,865	44.7	52,820	19.5	31,965	11.8
1899	253,870	65,803	25.9	100,503	39.6	59,399	23.4	28,165	11.1
1898	235,050	66,291	28.2	92,041	39.2	49,624	21.1	27,094	11.5
1897	220,571	64,858	29.4	102,807	46.6	36,398	16.5	16,508	7.5
1896	205,384	64,073	31.2	99,071	48.2	32,560	15.9	9,680	4.7
1895	169,917	57,737	34.0	84,900	50.0	21,408	12.6	5,872	3.4
1894	158,120	51,031	32.3	81,729	51.7	19,873	12.5	5,487	3.5
1893	147,033	50,270	34.2	69,290	47.1	19,200	13.1	8,273	5.6
1892	154,018	54,999	35.7	72,860	47.3	17,160	11.1	8,999	5.9
1891	126,839	50,992	40.2	50,028	39.5	17,800	14.0	8,019	6.3
1890	115,966	45,273	39.0	50,437	43.5	15,534	13.4	4,722	4.1
1889	101,239	39,364	38.9	43,849	43.3	13,654	13.5	4,372	4.3
1888	101,054	38,604	38.2	43,704	43.3	14,195	14.0	4,551	4.5
1887	81,017	33,941	41.9	35,133	43.4	7,910	9.7	4,033	5.0
1886	70,430	36,124	51.3	25,362	36.0	6,990	9.9	1,954	2.8
1885	74,052	32,209	43.5	30,267	40.9	10,137	13.7	1,439	1.9
1884	64,708	30,961	47.8	19,256	29.8	11,935	18.4	2,556	4.0
1883	51,574	26,653	51.7	11,011	21.3	10,658	20.7	3,252	6.3
1882	40,467	25,439	62.9					15,028	37.1
1881	32,000	24,363	76.1					7,637	23.9
1880	27,000	22,204	82.2					4,796	17.8
1879	23,000	19,129	83.2					3,871	16.8
1878	21,500	17,719	82.4					3,781	17.6
1877	21,000	17,422	83.0					3,578	17.0
1876	19,000	17,085	89.9					1,915	10.1
1875	18,000	16,089	89.4					1,911	10.6
1874	17,500	15,327	87.6					2,173	12.4
1873	15,500	13,433	86.7					2,067	13.3
1872	12,500	10,961	87.7					1,539	12.3
1871	13,000	11,942	91.9					1,058	8.1
1870	12,600	10,992	87.2					1,608	12.8
1869	12,500	11,886	95.1					614	4.9
1868	11,600	9,346	80.6					2,254	19.4
1867	10,000	7,824	78.2					2,176	21.8
1866	8,900	6,138	69.0					2,762	31.0
1865	8,500	6,410	75.4					2,090	24.6
1864	8,000	5,576	69.7					2,424	30.3
1863	8,500	5,797	68.2					2,703	31.8
1862	9,000	6,065	67.4					2,935	32.6
1861	7,500	6,713	89.5					787	10.5
1860	7,200	5,388	74.8					1,812	25.2
1859	6,300	3,985	63.3					2,315	36.7
1858	5,500	4,088	74.3					1,412	25.7
1857	4,800	4,255	88.6					545	11.4
1856	4,000	3,666	91.7					334	8.3
1855	3,000	2,593	86.4					407	13.6
1854	2,250	1,819	80.8					431	19.2
1853	2,000	1,297	64.9					703	35.1
1852	1,100	792	72.0					308	28.0
1851	900	779	86.6					121	13.4
1850	650	572	88.0					78	12.0
1849	700	672	96.0					28	4.0
1848	500	461	92.2					39	7.8
1847	300	213	71.0					87	29.0
1846	150	26	17.3					124	82.7
1845	100	12	12.0					88	88.0

[1] United States Geological Survey, "Mineral Resources of the United States," 1904.

The following statement presents a comparison of the production of smelters and refineries:

	Pounds.
Total production of copper placed on the market	939,327,142
Production of smelters	603,237,815
Imported material treated by refineries in the United States	57,684,506
Total	660,922,321
Difference	278,404,821
	939,327,142

The total production of copper placed on the market is the refined copper product, less the duplication of 23,829,109 pounds above noted and plus the copper exported in the form of matte.

The difference between the product of the refineries on the one hand and the product of the smelters, together with imported material, on the other represents the production of pig copper by smelters connected with refineries. The total product of refined copper by the latter class of establishments was equal to 480,453,170 pounds, which can be classified as follows:

	Pounds.
Smelted and refined	278,404,821
Refined only	202,048,349
Total	480,453,170

Practically all of the copper matte product of the lead smelters, amounting to 51,617,670 pounds of contained copper, figures as material in the returns of the copper refineries, as also does 3,689,000 pounds of blister copper produced by an establishment engaged primarily in the manufacture of other products.

An estimate of the quantity of copper electrolytically refined is obtained by deducting from the total quantity placed on the market, the copper exported in the form of matte, and the Lake copper product less that portion of the latter which is electrolytically treated. This gives 754,693,459 pounds as the estimated production of electrolytic copper.

THE INDUSTRY, BY STATES AND TERRITORIES.

The general statistics, by states and territories, for the censuses of 1900 and 1905 are shown by Table 6.

All of the states and territories for which details can be presented show an increase in products with the exception of California. The statistics for Colorado and Montana are included under "all other states," and although there are in each state 3 or more establishments, the state details can not be given without disclosing individual operations, because two or more plants are owned by one corporation.

The very large increase for New Jersey in cost of materials used and value of products, along with a decrease in wage-earners, wages, and miscellaneous expenses, is due to the growth in electrolytic refining and decrease in smelting in the eastern establishments. This change in smelting and refining conditions will be further considered in treating of the eastern and western establishments.

TABLE 6.—COPPER SMELTING AND REFINING—COMPARATIVE SUMMARY, BY STATES AND TERRITORIES: 1905 AND 1900.

STATE OR TERRITORY.	Census.	Number of establishments.	Capital.	Salaried officials, clerks, etc.: Number.	Salaried officials, clerks, etc.: Salaries.	Wage-earners and wages: Average number.	Wage-earners and wages: Wages.	Miscellaneous expenses.	Cost of materials used.	Value of products.
United States	1905	40	$76,824,640	809	$1,527,382	12,752	$10,827,043	$4,748,399	$196,736,986	$240,780,216
	1900	47	53,063,395	488	954,905	11,324	8,529,021	1,522,325	122,174,129	165,131,670
Arizona	1905	7	9,340,839	107	218,402	2,349	2,050,409	828,097	12,486,782	22,761,981
	1900	9	7,265,659	80	140,621	1,648	1,276,739	266,548	6,370,884	17,286,517
California	1905	3	946,000	21	34,867	413	401,240	77,383	1,317,972	2,583,524
	1900	3	1,114,882	21	25,357	381	342,491	90,026	1,379,423	4,508,259
Colorado[1]	1900	3	2,308,309	30	59,765	410	315,958	11,547	3,385,113	3,893,034
Michigan	1905	3	2,378,315	37	50,763	650	454,943	407,119	18,807,701	21,222,217
	1900	3	1,523,407	17	25,500	462	364,647	33,685	16,754,220	17,340,041
Montana[1]	1900	7	26,824,298	107	233,711	4,290	3,791,983	556,852	20,556,336	36,387,063
New Jersey	1905	5	7,892,904	102	129,187	1,243	644,577	275,705	58,811,990	62,795,613
	1900	7	6,943,886	74	138,728	1,707	915,112	290,423	32,545,179	38,365,131
Utah[2]	1905	5	3,584,788	32	97,850	1,416	1,016,052	63,453	5,133,999	8,498,956
All other states	[3] 1905	17	52,681,794	510	996,313	6,681	6,259,822	3,096,642	100,178,542	122,917,925
	[4] 1900	15	7,082,954	159	331,223	2,426	1,522,091	273,244	41,182,974	47,351,625

[1] Included in "all other states" in 1905.
[2] Included in "all other states" in 1900.
[3] Includes establishments distributed as follows: Colorado, 3; Idaho, 1; Maryland, 1; Montana, 5; New York, 2; Oregon, 1; Tennessee, 2; Virginia, 1; Washington, 1.
[4] Includes establishments distributed as follows: Connecticut, 2; Illinois, 1; Maryland, 1; Nevada, 1; New Mexico, 1; New York, 2; Ohio, 1; South Dakota, 1; Tennessee, 1; Utah, 2; Virginia, 1; Washington, 1.

Table 7 presents the comparative statistics for 1900 and 1905 of the establishments located east and west of the Mississippi river, with their respective per cents of increase.

TABLE 7.—COPPER SMELTING AND REFINING—COMPARATIVE SUMMARY OF ESTABLISHMENTS, BY LOCATION, EAST AND WEST OF THE MISSISSIPPI RIVER, WITH PER CENT OF INCREASE: 1905 AND 1900.

	TOTAL.		EAST OF THE MISSISSIPPI.		WEST OF THE MISSISSIPPI.		PER CENT OF INCREASE.		
	1905	1900	1905	1900	1905	1900	Total.	East.	West.
Number of establishments	40	47	14	19	26	28	[1]14.9	[1]26.3	[1]7.1
Capital	$76,824,640	$53,063,395	$20,444,672	$13,680,503	$56,379,968	$39,382,892	44.8	49.4	43.2
Salaried officials, clerks, etc., number	809	488	280	226	529	262	65.8	23.9	101.9
Salaries	$1,527,382	$954,905	$454,339	$416,981	$1,073,043	$537,924	60.0	9.0	99.5
Wage-earners, average number	12,752	11,324	4,422	4,083	8,330	7,241	12.6	8.3	15.0
Total wages	$10,827,043	$8,529,021	$2,567,758	$2,323,370	$8,259,285	$6,205,651	26.9	10.5	33.1
Miscellaneous expenses	$4,748,399	$1,522,325	$1,321,363	$551,228	$3,427,036	$971,097	211.9	139.7	252.9
Materials used, total cost	$196,736,986	$122,174,129	$139,182,413	$86,840,595	$57,554,573	$35,333,534	61.0	60.3	62.9
Ores and concentrates—									
Tons	7,361,473	4,524,033	566,530	156,256	6,794,943	4,367,777	62.7	262.6	55.6
Cost	$60,402,094	$25,190,522	$19,588,436	$733,622	$40,813,658	$24,456,900	139.8	2,570.1	66.9
Matte, purchased—									
Tons	29,265	53,964	8,608	49,229	20,657	4,735	[1]45.8	[1]82.5	336.3
Cost	$4,135,742	$10,513,431	$633,458	$9,767,037	$3,502,284	$746,394	[1]60.7	[1]93.5	369.2
Blister or anodes, purchased—									
Tons	372,607	318,102	372,607	318,102	....	....	17.1	17.1	....
Cost	$111,248,191	$72,401,654	$111,248,191	$72,401,654	....	....	53.7	53.7	....
All other materials	$20,950,959	$14,068,522	$7,712,328	$3,938,282	$13,238,631	$10,130,240	48.9	95.8	30.7
Products, aggregate value	$240,780,216	$165,131,670	$151,034,048	$97,832,016	$89,746,168	$67,299,654	45.8	54.4	33.4
Smelting, total value	$88,374,830	$54,275,173	$620,272	$1,140,140	$87,754,558	$53,135,033	62.8	[1]45.6	65.2
Copper (in matte, blister or anodes)—									
Pounds	620,872,420	334,679,443	5,334,097	6,570,418	615,538,323	328,109,025	85.5	[1]18.8	87.6
Value	$69,606,496	$43,365,047	$604,246	$898,462	$69,002,250	$42,466,585	60.5	[1]32.8	62.5
Silver—									
Ounces fine	21,945,304	8,866,472	6,708	305,487	21,938,596	8,560,985	147.5	[1]97.8	156.2
Value	$12,274,779	$5,020,050	$3,826	$172,033	$12,270,953	$4,848,017	144.5	[1]97.8	153.1
Gold—									
Ounces fine	321,747	300,914	610	3,486	321,137	297,428	6.9	[1]82.5	8.0
Value	$6,493,555	$5,890,076	$12,200	$69,645	$6,481,355	$5,820,431	10.2	[1]82.5	11.4
Refining, including smelting and refining, total value	$149,711,214	$107,635,247	$147,949,700	$93,470,626	$1,761,514	$14,164,621	39.1	58.3	[1]87.6
Ingots, bars, wire, etc.—									
Pounds	933,809,701	602,595,113	932,849,931	507,190,645	959,770	95,404,468	55.0	83.9	[1]99.0
Value	$119,420,862	$94,061,667	$119,294,238	$81,871,103	$126,624	$12,190,564	27.0	45.7	[1]99.0
Blue vitriol—									
Pounds	27,729,900	27,298,926	27,673,749	26,017,613	56,151	1,281,313	1.6	63.7	[1]95.6
Value	$1,120,368	$1,225,745	$1,117,593	$1,178,208	$2,775	$47,537	[1]8.6	[1]5.1	[1]94.2
Silver—									
Ounces fine	28,115,790	13,229,911	27,633,444	10,203,023	482,346	3,026,888	112.5	170.8	[1]84.1
Value	$16,034,886	$7,790,985	$15,754,560	$6,076,707	$280,326	$1,714,278	105.8	159.3	[1]83.6
Gold—									
Ounces fine	636,207	224,352	570,149	213,740	66,058	10,612	183.6	166.7	522.5
Value	$13,135,098	$4,556,850	$11,783,309	$4,344,608	$1,351,789	$212,242	188.2	171.2	536.9
All other products	$2,694,172	$3,221,250	$2,464,076	$3,221,250	$230,096	....	[1]16.4	[1]23.5	....

[1] Decrease.

Table 7 shows the growth and concentration of the refining industry in the east which has been a marked feature of the copper industry for the last few years. The following statement shows the percentages of the total capital, wage-earners, cost of materials, and value of products represented by the eastern and western establishments for 1900 and 1905, and illustrates the changes in smelting and refining conditions:

	EAST OF THE MISSISSIPPI.		WEST OF THE MISSISSIPPI.	
	1905	1900	1905	1900
Capital	26.6	25.8	73.4	74.2
Wage-earners	34.7	36.1	65.3	63.9
Cost of materials used	70.7	71.1	29.3	28.9
Value of products	62.7	59.2	37.3	40.8
Smelting	0.7	2.1	99.3	97.9
Refining, including smelting and refining	98.8	86.8	1.2	13.2

It will be seen that the proportionate share of the refining done for 1905 by the establishments west of the Mississippi was but one-eleventh of what it was for 1900, and practically all of the refining was done in the east. The operations of the western establishments are now confined almost entirely to smelting, with, in a majority of cases, the conversion of the matte into blister copper, which is electrolytically refined in the east.

The eastern establishments show an increase in capital and value of products proportionally greater than the western establishments, with a slight decrease in proportionate share of cost of materials used and in average number of wage-earners.

The statistics, for 1905, of the refineries handling the Lake Superior product, the same including, however, the expense pertaining to the refining of 9,000 tons of Montana anodes not separable from the rest of the expense, are as follows:

Refining Lake Superior mineral: 1905.

Expenditures, total	$1,697,943
Wages	$606,487
Superintendence	$74,104
Fuel	$367,457
Supplies and materials, not including cost of "mineral"	$204,997
Rent, interest, insurance, etc	$444,898
"Mineral" treated, tons	164,756
Refined copper product, pounds	205,189,233

The mineral treated averaged 62.3 per cent copper as against 65.1 per cent for 1900, the decrease in average grade being due to the increase in utilization by concentration of the finer slimes of the stamp mills. If the Montana anodes which were refined are figured at par with the Lake copper, in order to give an approximation to the average cost of refining, it gives 0.761 of a cent as the average expenditure per pound of refined copper, as compared with 0.591 of a cent deduced at the census of 1900.

MATERIALS USED.

Table 8 exhibits the quantity and the cost of ma-

TABLE 8.—*Copper smelting and refining—materials used, by kind, quantity, and cost, with number of establishments reporting: 1905 and 1900.*

KIND.	Census.	Number of establishments reporting.	Tons.	Cost.
Total	1905	40	....	$196,736,986
	1900	47	....	122,174,129
Ores and concentrates	1905	34	7,361,473	60,402,094
	1900	33	4,524,033	25,190,522
Matte, purchased	1905	[illegible]	29,265	4,135,742
	1900	11	53,964	10,513,431
Blister or anodes, purchased	1905	9	372,607	111,248,191
	1900	13	318,102	72,401,654
All other materials, including fuel, mill supplies, etc.	1905	....	....	20,950,959
	1900	....	....	14,068,522

The consumption of ore shows an increase of 62.7 per cent in quantity, and blister or anodes, purchased, an increase of 17.1 per cent, while matte, purchased, shows a decrease of 45.8 per cent. The decrease in matte, purchased, is due to the more general use by the smelters of the Bessemerizing process and the conversion of their matte into blister copper, which is electrolytically refined by the refineries with a recovery of the precious metals contained in the crude copper.

Of the ores and concentrates consumed by all classes of smelters, 6,123,770 tons, valued at $38,884,183, were from mines operated by the same owners, and 1,237,703 tons, valued at $21,517,911, were purchased.

The consumption of copper yielding materials, by states, for the census years 1900 and 1905, is shown by Table 9.

TABLE 9.—*Copper smelting and refining—principal materials used by kind and quantity, and by states and territories: 1905 and 1900.*

STATE OR TERRITORY.	Census.	Ores and concentrates (tons).	Matte, purchased (tons).	Blister, or anodes purchased (tons).
United States	1905	7,361,473	29,265	372,607
	1900	4,524,033	53,964	318,102
Arizona	1905	1,231,468	3,349	....
	1900	842,959	1,583	....
California	1905	270,006	....	....
	1900	250,041	22	....
Michigan	1905	[1] 128,119	....	9,000
	1900	....	....	[1] 93,914
New Jersey	1905	345	2,796	169,435
	1900	4,218	33,351	81,611
Utah	1905	744,929	5,488	....
	1900	73,127	....	....
All other states	[2] 1905	4,986,606	17,632	194,172
	[3] 1900	3,353,688	19,008	142,577

[1] "Mineral."
[2] Includes states as follows: Colorado, Idaho, Maryland, Montana, New York, Oregon, Tennessee, Virginia, Washington.
[3] Includes states as follows: Colorado, Connecticut, Illinois, Maryland, Montana, Nevada, New Mexico, New York, South Dakota, Tennessee, Virginia, Washington.

The Western states consumed 6,794,943 tons of ore, or 92.3 per cent of the total quantity, as compared

quantity of ores and concentrates smelted as compared with a little over six-tenths of the total quantity for 1900. As the details for Montana can not be shown in the general tables, on account of the ownership of all establishments by less than 3 corporations, the statistics for the state are included in "all other states" in all tables. Arizona was second with 16.7 per cent of the ores smelted for 1905 as compared with 18.6 per cent of all ores for 1900; Utah, third with 10.1 per cent; Tennessee, fourth; and California, which ranked third for 1900, fifth with 3.7 per cent. The refineries in New Jersey, New York, and Maryland make these states the largest consumers of matte and blister copper or anodes.

There were 24 establishments which reported only a consumption of ore for 1905 as compared with 26 in 1900; 6 which reported only matte and blister copper or anodes for 1905, as compared with 13 for 1900, and 10 which used both classes of material. Table 10 gives the comparative statistics, for 1900 and 1905, of all establishments according to this grouping, with the per cent of increase.

TABLE 10.—COPPER SMELTING AND REFINING—ESTABLISHMENTS CLASSIFIED ACCORDING TO KIND OF MATERIALS USED: 1905 AND 1900.

	TOTAL.		ESTABLISHMENTS USING ORES ONLY.		ESTABLISHMENTS USING MATTE AND BLISTER OR ANODES ONLY.		ALL OTHER ESTABLISHMENTS.		PER CENT OF INCREASE.			
	1905	1900	1905	1900	1905	1900	1905	1900	Total.	Ores only.	Matte and blister or anodes only.	All other.
Number of establishments	40	47	24	26	6	13	10	8	[1] 14.9	[1] 7.7	[1] 53.8	25.0
Capital	$76,824,640	$53,063,395	$45,536,164	$35,973,221	$9,430,804	$9,232,105	$21,857,672	$7,858,069	44.8	26.6	2.2	178.2
Salaried officials, clerks, etc., number	809	488	488	239	134	124	187	125	65.8	104.2	8.1	49.6
Salaries	$1,527,382	$954,905	$971,628	$494,695	$204,817	$211,031	$350,937	$249,179	60.0	96.4	[1] 2.9	40.8
Wage-earners, average number	12,752	11,324	6,806	6,399	2,043	2,344	3,903	2,581	12.6	6.4	[1] 12.8	51.2
Total wages	$10,827,043	$8,529,021	$6,753,996	$5,586,784	$1,091,025	$1,393,006	$2,982,022	$1,549,231	26.9	20.9	[1] 21.7	92.5
Miscellaneous expenses	$4,748,399	$1,522,325	$3,521,146	$938,139	$297,406	$192,272	$929,847	$391,914	211.9	275.3	54.7	137.3
Materials used, total cost	$196,736,986	$122,174,129	$52,017,764	$32,028,770	$78,660,651	$74,103,544	$66,058,571	$16,041,815	61.0	62.4	6.1	311.8
Ores and concentrates—												
Tons	7,361,473	4,524,033	6,070,017	4,143,865	....	....	1,291,456	380,168	62.7	46.5	....	239.7
Cost	$60,402,094	$25,190,522	$41,025,045	$22,858,610	....	....	$19,377,049	$2,331,912	139.8	79.5	....	731.0
Matte and blister or anodes, purchased—												
Tons	401,872	372,066	....	....	229,624	316,792	172,248	55,274	8.0	....	[1] 27.5	211.6
Cost	$115,383,933	$82,915,085	....	....	$77,438,166	$72,300,591	$37,945,767	$10,614,494	39.2	....	7.1	257.5
All other materials	$20,950,959	$14,068,522	$10,992,719	$9,170,160	$1,222,485	$1,802,953	$8,735,755	$3,095,409	48.9	19.9	[1] 32.2	182.2
Products, aggregate value	$240,780,216	$165,131,670	$80,107,081	$58,892,793	$83,442,793	$82,438,564	$77,230,342	$23,800,313	45.8	36.0	1.2	224.5
Smelting, total value	$88,374,830	$54,275,173	$69,562,830	$44,775,709	....	....	$18,812,000	$9,499,464	62.8	55.4	....	98.0
Copper (in matte and blister or anodes)—												
Pounds	620,872,420	334,679,443	493,907,472	271,615,580	....	....	126,964,948	63,063,863	85.5	81.8	....	101.3
Value	$69,606,496	$43,365,047	$55,564,588	$34,681,445	....	....	$14,041,908	$8,683,602	60.5	60.2	....	61.7
Silver—												
Ounces fine	21,945,304	8,866,472	17,073,451	7,906,717	....	....	4,871,853	959,755	147.5	115.9	....	407.6
Value	$12,274,779	$5,020,050	$9,485,759	$4,456,251	....	....	$2,789,020	$563,799	144.5	112.9	....	394.7
Gold—												
Ounces fine	321,747	300,914	224,168	281,981	....	....	97,579	18,933	6.9	[1] 20.5	....	415.4
Value	$6,493,555	$5,890,076	$4,512,483	$5,638,013	....	....	$1,981,072	$252,063	10.2	[1] 20.0	....	685.9
Refining, including smelting and refining, total value	$149,711,214	$107,635,247	$10,314,155	$14,117,084	$80,978,717	$80,890,954	$58,418,342	$12,627,209	39.1	[1] 26.9	0.1	362.6
Ingots, bars, wire, etc.—												
Pounds	933,809,701	602,595,113	68,315,799	95,404,468	453,437,635	442,307,615	412,056,267	64,883,030	55.0	[1] 28.4	2.5	535.1
Value	$119,420,862	$94,061,667	$8,686,013	$12,190,564	$59,240,027	$71,652,928	$51,494,822	$10,218,175	27.0	[1] 28.7	[1] 17.3	404.0
Blue vitriol—												
Pounds	27,729,900	27,298,926	56,151	....	7,645,949	13,017,613	20,027,800	14,281,313	1.6	....	[1] 41.3	40.2
Value	$1,120,368	$1,225,745	$2,775	....	$306,860	$578,208	$810,733	$647,537	[1] 8.6	....	[1] 46.9	25.2
Silver—												
Ounces fine	28,115,790	13,229,911	472,045	3,026,888	23,039,687	9,555,948	4,604,058	647,075	112.5	[1] 84.4	141.1	611.5
Value	$16,034,886	$7,790,985	$274,660	$1,714,278	$13,163,234	$5,688,470	$2,596,992	$388,237	105.8	[1] 84.0	131.4	568.9
Gold—												
Ounces fine	636,207	224,352	66,004	10,612	400,058	145,066	170,145	68,674	183.6	522.0	175.8	147.8
Value	$13,135,098	$4,556,850	$1,350,707	$212,242	$8,268,596	$2,971,348	$3,515,795	$1,373,260	188.2	536.4	178.3	156.0
All other products	$2,694,172	$3,221,250	$230,096	....	$2,464,076	$1,547,610	....	$1,673,640	[1] 16.4	....	59.2	....

[1] Decrease.

Of the establishments which used ore only, 21 were smelters alone and 3 produced refined products. This group of establishments consumed 6,070,017 tons of ore, as compared with 4,143,865 tons for 1900, an increase of 46.5 per cent, and their products were 34,158 tons of refined copper, as compared with 47,702 tons for 1900; 246,954 tons of copper in matte and blister or anodes, as compared with 135,808 tons for 1900; 17,545,496 ounces of silver, as compared with 10,933,605 ounces for 1900; and 290,172 ounces of gold, as compared with 292,593 ounces for 1900.

The proportions which the different items of expenditures, viz, salaries, wages, miscellaneous expenses, and cost of materials, are of the total expense in the several groups of establishments may be deduced for comparative purposes. Table 11 shows, for 1900 and 1905, each item of cost and the percentage which it forms of the total cost for each of the foregoing groups or classes of establishments.

TABLE 11.—COPPER SMELTING AND REFINING—SALARIES, WAGES, MISCELLANEOUS EXPENSES, AND COST OF MATERIALS FOR ESTABLISHMENTS CLASSIFIED ACCORDING TO KIND OF MATERIALS USED, WITH PER CENT WHICH EACH ITEM FORMS OF TOTAL: 1905 AND 1900.

	Census.	TOTAL.		ESTABLISHMENTS USING ORES ONLY.		ESTABLISHMENTS USING MATTE AND BLISTER OR ANODES ONLY.		ALL OTHER ESTABLISHMENTS.	
		Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.
Total	1905	$213,839,810	100.0	$63,264,534	100.0	$80,253,899	100.0	$70,321,377	100.0
	1900	133,180,380	100.0	39,048,388	100.0	75,899,853	100.0	18,232,139	100.0
Salaries	1905	1,527,382	0.7	971,628	1.5	204,817	0.2	350,937	0.5
	1900	954,905	0.7	494,695	1.3	211,031	0.3	249,179	1.4
Wages	1905	10,827,043	5.1	6,753,996	10.7	1,091,025	1.4	2,982,022	4.3
	1900	8,529,021	6.4	5,586,784	14.3	1,393,006	1.8	1,549,231	8.5
Miscellaneous expenses	1905	4,748,399	2.2	3,521,146	5.6	297,406	0.4	929,847	1.3
	1900	1,522,325	1.2	938,139	2.4	192,272	0.3	391,914	2.1
Cost of materials used	1905	196,736,986	92.0	52,017,764	82.2	78,660,651	98.0	66,058,571	93.9
	1900	122,174,129	91.7	32,028,770	82.0	74,103,544	97.6	16,041,815	88.0

In each group the proportionate share of the expense represented by labor has decreased, the decrease being relatively the largest in the group designated as "all other establishments," which are establishments that use both ores and matte, or blister copper, and in general do both smelting and refining. The labor factor is largest in establishments using ore only and smallest in the establishments using matte and blister or anodes only. Naturally the cost of materials used forms the largest proportionate share of the expense in the group of establishments which chiefly refine, a less per cent in the group using all classes of materials, and a still less per cent of the total in the group using ores only.

PRODUCTS.

The quantities and values of the products of the smelters and refineries, with the number of establishments producing each respective product, are shown in detail in Table 12 for the censuses of 1900 and 1905.

The fine copper contents of matte does not include matte produced as an intermediate product, but only matte produced and sold as such. The matte product of the smelters shows a decrease of 55,890,358 pounds in copper contents, or 40.6 per cent, for the period 1900 to 1905, while the copper product of smelters in form of blister copper or anodes increased 342,083,335 pounds, or 173.6 per cent. The change, as before noted, is due to the more extended use of converters and the Bessemerizing process. In 1900 there were 21 smelters which sold their product, in whole or in part, in the form of matte, while for 1905 there were only 12.

The smelting of 21,945,304 ounces of silver was reported by 23 copper smelting establishments for 1905, compared with 8,866,472 ounces of silver by 25 establishments in 1900; and 321,747 ounces of gold by 22 establishments for 1905, as against 300,914 ounces of gold by 23 establishments in 1900.

TABLE 12.—*Copper smelting and refining—products, by kind, quantity, and value, with number of establishments reporting: 1905 and 1900.*

KIND.	Census.	Number of establishments reporting.	PRODUCTS. Unit of measure.	Quantity.	Value.
Aggregate value	1905				$240,780,216
	1900				165,131,670
Smelting, total value	1905				88,374,830
	1900				54,275,173
Fine copper contents of blister or anodes	1905	15	Pound	539,140,069	60,163,414
	1900	15	Pound	197,056,734	25,853,917
Fine copper contents of matte.	1905	12	Pound	81,732,351	9,443,082
	1900	21	Pound	137,622,709	17,511,130
Silver	1905	23	Ounce fine	21,945,304	12,274,779
	1900	25	Ounce fine	8,866,472	5,020,050
Gold	1905	22	Ounce fine	321,747	6,493,555
	1900	23	Ounce fine	300,914	5,890,076
Refining, total value	1905				149,711,214
	1900				107,635,247
Ingots, wire, bars, etc.	1905	13	Pound	933,809,701	119,420,862
	1900	18	Pound	602,595,113	94,061,667
Blue vitriol	1905	5	Pound	27,729,900	1,120,368
	1900	7	Pound	27,298,926	1,225,745
Silver	1905	9	Ounce fine	28,115,790	16,034,886
	1900	11	Ounce fine	13,229,911	7,790,985
Gold	1905	7	Ounce fine	636,207	13,135,098
	1900	10	Ounce fine	224,352	4,556,850
All other products	1905				2,694,172
	1900				3,221,250

There were 9 refineries, or smelters and refineries combined, for 1905 which reported a product of 28,115,790 ounces of silver, as compared with 11 refineries in 1900, with 13,229,911 ounces of silver; and 7 reported 636,207 ounces of gold, as compared with 10

establishments, with a product of 224,352 ounces of gold in 1900.

There are two commercial methods of handling the materials shipped for treatment to smelters and refineries—they are either bought outright or treated on a toll basis. The cost of materials and the quantity and value of products shown in the present report combine both classes of materials—those bought and sold, as well as those treated on toll. The value of the products of materials treated on toll was estimated on the basis of the average prices reported by other establishments in the same locality, and the cost of materials was determined by deducting from the estimated value of the products the tolls received for treating them. The following statement shows the comparative prevalence of each method:

	COPPER PRODUCTION.		
	Total (pounds).	Returned to patrons (pounds).	Sold (pounds).
Smelters only	620,872,420	2,942,600	617,929,820
Refineries, with or without smelters	933,809,701	596,329,663	337,480,038

For 1905 there was received by the smelters $117,680 on account of contract smelting, as against $293,961 in 1900, and by the refineries or smelters and refineries the sum of $4,806,039, as against $3,452,855 in 1900; a total of $4,923,719 for 1905 as compared with a total of $3,746,816 in 1900, or an increase of 31.4 per cent.

Table 13 shows the quantities of each product for the two branches of the industry—smelting and refining—by states, for the censuses of 1900 and 1905.

TABLE 13.—COPPER SMELTING AND REFINING—PRINCIPAL PRODUCTS, BY KIND AND QUANTITY, AND BY STATES AND TERRITORIES: 1905 AND 1900.

STATE OR TERRITORY.	Census.	SMELTING.				REFINING.			
		Fine copper contents of blister or anodes (pounds).	Fine copper contents of matte (pounds).	Silver (ounces fine).	Gold (ounces fine).	Ingots, wire, bars, etc. (pounds).	Blue vitriol (pounds).	Silver (ounces fine).	Gold (ounces fine).
United States	1905	539,140,069	81,732,351	21,945,304	321,747	933,809,701	27,729,900	28,115,790	636,207
	1900	197,056,734	137,622,709	8,866,472	300,914	602,595,113	27,298,926	13,229,911	224,352
Arizona	1905	172,015,713	15,577,539	1,371,762	37,629	...	(1)	...	...
	1900	75,127,116	52,832,952	711,373	18,074	...	(1)	...	...
California	1905	17,010,365	2,561,660	558,883	14,550	...	...	...	...
	1900	84,000	25,863,637	427,315	23,328	...	...	...	...
Michigan	1905	...	...	...	...	173,287,133	...	9,000	...
	1900	...	...	...	...	102,001,189	...	...	...
New Jersey	1905	...	...	...	...	332,855,640	7,645,949	19,241,470	356,700
	1900	2,930,000	...	301,800	3,453	170,326,925	1,818,272	7,594,285	150,949
Utah	1905	37,092,778	2,741,302	3,363,431	109,270	...	...	...	...
	1900	6,139,757	...	88,202	7,625	...	...	...	...
All other states	[2] 1905	313,021,213	60,851,850	16,651,228	160,298	427,666,928	20,083,951	8,865,320	279,507
	[3] 1900	112,775,861	58,926,120	7,337,782	248,434	330,266,999	25,480,654	5,635,626	73,403

[1] Included in "all other states."
[2] Includes states as follows: Colorado, Idaho, Maryland, Montana, New York, Oregon, Tennessee, Virginia, Washington.
[3] Includes states as follows: Colorado, Connecticut, Illinois, Maryland, Montana, Nevada, New Mexico, New York, South Dakota, Tennessee, Virginia, Washington.

The state of New Jersey continues to be the largest producer of refined copper with a large gain in its proportion of the total, its product constituting 35.6 per cent of the total in 1905 and 28.3 per cent in 1900. The refining industry in the state of New York has also made a very heavy advance, so that the states of New Jersey and New York refined nearly two-thirds of the copper product of the country. Michigan was third and Maryland fourth.

The states west of the Mississippi river produced 615,538,323 pounds of the fine copper contents of blister or anodes and matte, out of the total of 620,872,420 pounds, or 99.1 per cent, compared with 98 per cent in 1900.

PROCESS EMPLOYED—SMELTING, REFINING, AND SMELTING AND REFINING.

Table 14 presents the comparative statistics for 1900 and 1905 for the establishments grouped according to process employed—those doing smelting only, those doing refining only, and those doing both smelting and refining—with the per cent of increase for each group.

A comparison of the statistics shows a movement toward a separation of smelting and refining. There was a decrease of 36.2 per cent in the capital invested in refineries and in smelters combined with refineries, and an increase of 185.6 per cent in the capital invested in smelters; and the average number of wage-earners

employed by refineries and by smelters combined with refineries shows a decrease from 7,121 for 1900 to 4,327 for 1905, or 39.2 per cent, while the average number of wage-earners employed by smelters only has increased 100.5 per cent. The movement toward a separation of the two branches of the industry is further shown by the materials used. In 1900 the refineries and the smelters combined with refineries handled 2,403,547 tons of ore, costing $12,849,737, or an average of $5.35 per ton, and the establishments doing smelting only handled 2,120,486 tons of ore of an average cost of $5.82 per ton. For 1905, however, the smelters combined with refineries handled 461,022 tons of ore of an average cost of $45.12 per ton and the detached smelters 6,900,451 tons of an average cost of $5.74 per ton. That is, an increasing proportion of the smelting is being done by establishments which do smelting only, and the ores that go to establishments doing smelting and refining are high-grade ores or concentrates.

Table 14.—COPPER SMELTING AND REFINING—ESTABLISHMENTS CLASSIFIED ACCORDING TO PROCESS EMPLOYED: 1905 AND 1900.

	TOTAL.		SMELTING.		REFINING.		SMELTING AND REFINING.		PER CENT OF INCREASE.			
	1905	1900	1905	1900	1905	1900	1905	1900	Total.	Smelting.	Refining.	Smelting and refining.
Number of establishments	40	47	27	27	5	15	8	5	[1]14.9	...	[1]66.7	60.0
Capital	$76,824,640	$53,063,395	$55,337,938	$19,375,065	$9,300,804	$12,166,962	$12,185,898	$21,521,368	44.8	185.6	[1]23.6	[1]43.4
Salaried officials, clerks, etc., number	809	488	525	221	133	180	151	87	65.8	137.6	[1]26.1	73.6
Salaries	$1,527,382	$954,905	$1,052,370	$435,784	$202,317	$335,526	$272,695	$183,595	60.0	141.5	[1]39.7	48.5
Wage-earners, average number	12,752	11,324	8,425	4,203	2,041	3,213	2,286	3,908	12.6	100.5	[1]36.5	[1]41.5
Total wages	$10,827,043	$8,529,021	$8,220,168	$3,576,429	$1,089,025	$1,895,705	$1,517,850	$3,056,887	26.9	129.8	[1]42.6	[1]50.3
Miscellaneous expenses	$4,748,399	$1,522,325	$3,393,795	$621,573	$296,406	$388,243	$1,058,198	$512,509	211.9	446.0	[1]23.7	106.5
Materials used, total cost	$196,736,986	$122,174,129	$56,344,453	$18,558,130	$78,648,531	$80,268,059	$61,744,002	$23,347,940	61.0	203.6	[1]2.0	164.4
Ores and concentrates—												
Tons	7,361,473	4,524,033	6,900,451	2,120,486	...	54,099	461,022	2,349,448	62.7	225.4	...	[1]80.4
Cost	$60,402,094	$25,190,522	$39,600,927	$12,340,785	...	$477,004	$20,801,167	$12,372,733	139.8	220.9	...	68.1
Matte and blister or anodes—												
Tons	401,872	372,066	20,657	3,250	229,504	349,681	151,711	19,135	8.0	535.6	[1]34.4	692.8
Cost	$115,383,933	$82,915,085	$3,502,284	$621,393	$77,428,166	$77,713,691	$34,453,483	$4,580,001	39.2	463.6	[1]0.4	652.3
All other materials	$20,950,959	$14,068,522	$13.241,242	$5,595,952	$1,220,365	$2,077,364	$6,489 352	$6,395,206	48.9	136.6	[1]41.3	1.5
Products, aggregate value	$240,780,216	$165,131,670	$88,374,830	$38,173,276	$83,427,613	$90,168,236	$68,977,773	$36,790,158	45.8	131.5	[1]7.5	87.5
Smelting, total value	$88,374,830	$54,275,173	$88,374,830	$38,173,276	...	...	(2)	$16,101,897	62.8	131.5	...	...
Fine copper contents of blister or anodes—												
Pounds	539,140,069	197,056,734	539,140,069	88,263,325	...	...	(2)	108,793,409	173.6	510.8	...	...
Value	$60,163,414	$25,853,917	$60,163,414	$11,623,280	...	...	...	$14,230,637	132.7	417.6	...	...
Fine copper contents of matte—												
Pounds	81,732,351	137,622,709	81,732,351	137,359,799	...	...	(2)	262,910	[1]40.6	[1]40.5	...	...
Value	$9,443,082	$17,511,130	$9,443,082	$17,472,588	...	...	...	$38,542	[1]46.1	[1]46.0	...	...
Silver—												
Ounces fine	21,945,304	8,866,472	21,945,304	5,995,892	...	...	(2)	2,870,580	147.5	266.0	...	...
Value	$12,274,779	$5,020,050	$12,274,779	$3,463,235	...	...	...	$1,556,815	144.5	254.4	...	...
Gold—												
Ounces fine	321,747	300,914	321,747	287,116	...	...	(2)	13,798	6.9	12.1	...	...
Value	$6,493,555	$5,890,076	$6,493,555	$5,614,173	...	...	...	$275,903	10.2	15.7	...	...
Refining, total value	$149,711,214	$107,635,247	...	...	$80,963,537	$88,620,626	$68,747,677	$19,014,621	39.1	...	[1]8.6	261.5
Ingots, wire, bars, etc.—												
Pounds	933,809,701	602 595,113	...	...	453,356,531	475,930,645	480,453,170	126,664,468	55.0	...	[1]4.7	279.3
Value	$119,420,862	$94,061,667	...	...	$59,231,595	$77,021,103	$60,189,267	$17,040,564	27.0	...	[1]23.1	253.2
Blue vitriol—												
Pounds	27,729,900	27,298,926	...	...	7,645,949	26,017,613	20,083,951	1,281,313	1.6	...	[1]70.6	1,467.5
Value	$1,120,368	$1,225,745	...	...	$306,860	$1,178,208	$813,508	$47,537	[1]8.6	...	[1]74.0	1,611.3
Silver—												
Ounces fine	28,115,790	13,229,911	...	...	23,029,386	10,203,023	5,086,404	3,026,888	112.5	...	125.7	68.0
Value	$16,034,886	$7,790,985	...	...	$13,157,568	$6,076,707	$2,877,318	$1,714,278	105.8	...	116.5	67.8
Gold—												
Ounces fine	636,207	224,352	...	...	400,004	213,740	236,203	10,612	183.6	...	87.1	2,125.8
Value	$13,135,098	$4,556,850	...	...	$8,267,514	$4,344,608	$4,867,584	$212,242	188.2	...	90.3	2,193.4
All other products	$2,694,172	$3,221,250	...	...	$2,464,076	$1,547,610	$230,096	$1,673,640	[1]16.4	...	59.2	[1]86.3

[1] Decrease.

[2] The contents of intermediate products of smelting department which constituted material for refining was: Copper, 12,578,417 pounds; silver, 485,598 ounces fine; gold, 66,086 ounces fine.

Table 15 shows, for the censuses of 1900 and 1905, the items of expense and the percentage which each is of the total for the establishments in each of the groups given in Table 14.

In the case of establishments doing smelting only the proportional expenditure for labor is larger than in the case of refineries and that for material less. In all groups the proportional expenditure for labor shows a decrease for 1905 over 1900 and that for materials, an increase; and further, the proportional expenditures for labor and materials for establishments doing both smelting and refining is approaching that of the establishments which do refining only.

TABLE 15.—COPPER SMELTING AND REFINING—SALARIES, WAGES, MISCELLANEOUS EXPENSES, AND COST OF MATERIALS FOR ESTABLISHMENTS CLASSIFIED ACCORDING TO PROCESS EMPLOYED, WITH PER CENT WHICH EACH ITEM FORMS OF TOTAL: 1905 AND 1900.

	Census.	TOTAL.		SMELTING.		REFINING.		SMELTING AND REFINING.	
		Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.
Total	1905	$213,839,810	100.0	$69,010,786	100.0	$80,236,279	100.0	$64,592,745	100.0
	1900	133,180,380	100.0	23,191,916	100.0	82,887,533	100.0	27,100,931	100.0
Salaries	1905	1,527,382	0.7	1,052,370	1.5	202,317	0.2	272,695	0.4
	1900	954,905	0.7	435,784	1.9	335,526	0.4	183,595	0.7
Wages	1905	10,827,043	5.1	8,220,168	11.9	1,089,025	1.4	1,517,850	2.4
	1900	8,529,021	6.4	3,576,429	15.4	1,895,705	2.3	3,056,887	11.3
Miscellaneous expenses	1905	4,748,399	2.2	3,393,795	4.9	296,406	0.4	1,058,198	1.6
	1900	1,522,325	1.2	621,573	2.7	388,243	0.5	512,509	1.9
Cost of materials used	1905	196,736,986	92.0	56,344,453	81.7	78,648,531	98.0	61,744,002	95.6
	1900	122,174,129	91.7	18,558,130	80.0	80,268,059	96.8	23,347,940	86.1

GROSS AND NET VALUE OF PRODUCTS.

The values of products hereinbefore considered are the net values at the works. In making the canvass for the census of 1905 it was desired to ascertain the gross value of the products as well as the net amount received, the former being the net value, plus the amount paid for treatment, and for freight on the product to the smelter or refinery, and for commissions and selling expense.

Table 16 shows, for the census of 1905, the gross and net values of products and the deductions for refining tolls, freight, and selling expense for establishments reporting the same, by states.

TABLE 16.—COPPER SMELTING AND REFINING—ESTABLISHMENTS REPORTING GROSS AND NET VALUES OF PRODUCTS: 1905.

	Number of establishments.	PRODUCTS.				DEDUCTIONS.				Products, net value.
		Total gross value.	Copper and copper contents.		Gold, silver, and other products, gross value.	Total.	Tolls paid for refining.	Freight.	Commissions and selling expenses.	
			Pounds.	Gross value.						
All establishments	40	....	....	....	....	....	....	....	....	$240,780,216
Establishments reporting gross and net values	29	$145,775,565	939,211,635	$119,503,347	$26,272,218	[1] $10,347,562	$4,458,851	$2,825,057	$1,447,680	135,428,003
Smelters, total	24	90,880,376	572,290,970	72,623,376	18,257,000	[1] 9,127,967	4,417,458	2,773,413	1,421,254	81,752,409
Arizona	7	25,300,424	187,593,252	23,688,231	1,612,193	[1] 2,538,443	1,086,673	873,267	404,737	22,761,981
Utah	5	9,150,100	39,834,080	5,001,201	4,148,899	[1] 651,144	209,090	178,484	44,610	8,498,956
All other states [2]	12	56,429,852	344,863,638	43,933,944	12,495,908	[1] 5,938,380	3,121,695	1,721,662	971,907	50,491,472
Smelters and refineries [3]	5	54,895,189	366,920,665	46,879,971	8,015,218	[1] 1,219,595	41,393	51,644	26,426	53,675,594

[1] Includes $1,615,974 of deductions not reported in detail. This total was distributed as follows: Smelters, $515,842—Arizona, $173,766; Utah, $218,960; "all other states" $123,116—smelters and refineries, $1,100,132.
[2] Includes establishments distributed as follows: California, 2; Colorado, 2; Idaho, 1; Montana, 4; Oregon, 1; Virginia, 1; Washington, 1.
[3] Includes establishments distributed as follows: Colorado, 1; Michigan, 2; New York, 1; Tennessee, 1.

There were 24 of the 27 smelting establishments which reported gross and net values, and 5 of the 8 smelters and refineries, or a total of 29 out of the 40 establishments. The total products with a net value of $135,428,003 are the products against which deductions were reported, the deductions aggregating $10,347,562. Of this amount $1,615,974 was reported without any distribution being made between tolls paid for refining, freight, or commissions and selling expenses, hence it is included in the total amount of deductions but not in the segregated columns. If the deductions are all charged against the copper, it gives an average of 1.1 cents per pound of copper for the average expense of marketing the copper product of the smelters.

The detailed statistics for the copper smelting and refining industry at the census of 1905 are given in Table 17. The amount received for contract smelting and refining is given, but the ores thus treated are included in the quantities and values of the materials and products.

TABLE 17.—COPPER SMELTING AND REFINING—DETAILED SUMMARY, BY STATES AND TERRITORIES: 1905.

	United States.	Arizona.	California.	Michigan.	New Jersey.	Utah.	All other states.[1]
Number of establishments	40	7	3	3	5	5	17
Capital, total	$76,824,640	$9,340,839	$946,000	$2,378,315	$7,892,904	$3,584,788	$52,681,794
Land	$2,776,114	$420,000	$7,000	$258,727	$386,250	$107,478	$1,596,659
Buildings	$18,962,965	$1,762,285	$141,000	$399,000	$1,522,810	$1,287,679	$13,850,191
Machinery, tools, and implements	$15,815,148	$2,490,117	$183,000	$1,304,041	$3,521,940	$1,208,372	$7,107,678
Cash and sundries	$39,270,413	$4,668,437	$615,000	$416,547	$2,461,904	$981,259	$30,127,266
Proprietors and firm members	1						1
Salaried officials, clerks, etc.:							
Total number	809	107	21	37	102	32	510
Total salaries	$1,527,382	$218,402	$34,867	$50,763	$129,187	$97,850	$996,313
Officers of corporations—							
Number	39	17			1	4	17
Salaries	$205,535	$61,045			$6,000	$21,500	$116,990
General superintendents, managers, clerks, etc.—							
Total number	770	90	21	37	101	28	493
Total salaries	$1,321,847	$157,357	$34,867	$50,763	$123,187	$76,350	$879,323
Men—							
Number	745	89	21	37	99	26	473
Salaries	$1,298,827	$155,557	$34,867	$50,763	$121,787	$74,600	$861,253
Women—							
Number	25	1			2	2	20
Salaries	$23,020	$1,800			$1,400	$1,750	$18,070
Wage-earners, including pieceworkers, and total wages:							
Greatest number employed at any one time during the year	15,349	3,102	433	697	1,464	1,758	7,895
Least number employed at any one time during the year	10,614	1,899	393	611	1,048	1,121	5,542
Average number	12,752	2,349	413	650	1,243	1,416	6,681
Total wages	$10,827,043	$2,050,409	$401,240	$454,943	$644,577	$1,016,052	$6,259,822
Men 16 years and over—							
Average number	12,702	2,348	413	650	1,243	1,416	6,632
Wages	$10,808,442	$2,050,049	$401,240	$454,943	$644,577	$1,016,052	$6,241,581
Children under 16 years—							
Average number	50	1					49
Wages	$18,601	$360					$18,241
Average number of wage-earners, including pieceworkers, employed during each month:							
Men 16 years and over—							
January	11,928	2,192	427	643	1,155	1,133	6,378
February	12,170	2,241	413	637	1,166	1,196	6,517
March	12,441	2,523	395	636	1,197	1,297	6,393
April	12,860	2,863	397	672	1,236	1,380	6,312
May	13,031	2,771	408	689	1,214	1,451	6,498
June	13,092	2,607	412	693	1,219	1,595	6,566
July	12,716	2,077	422	643	1,269	1,656	6,649
August	12,682	2,082	416	667	1,272	1,467	6,778
September	12,627	2,016	415	646	1,271	1,427	6,852
October	12,954	2,243	423	636	1,297	1,469	6,886
November	12,872	2,243	418	616	1,324	1,489	6,782
December	13,051	2,318	410	622	1,296	1,432	6,973
Children under 16 years—							
January	49	1					48
February	53	1					52
March	52	1					51
April	44	1					43
May	53	1					52
June	48	1					47
July	48	1					47
August	51	1					50
September	42	1					41
October	54	1					53
November	54	1					53
December	52	1					51
Miscellaneous expenses, total	$4,748,399	$828,097	$77,383	$407,119	$275,705	$63,453	$3,096,642
Rent of works	$1,342,753	$4,935				$120	$1,337,698
Taxes	$374,810	$95,367	$29,041	$10,826	$16,162	$17,406	$206,008
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$2,913,435	$623,394	$48,342	$396,293	$259,543	$45,927	$1,539,936
Contract work	$117,401	$104,401					$13,000
Materials used, total cost	$196,736,986	$12,486,782	$1,317,972	$18,807,701	$58,811,990	$5,133,999	$100,178,542
Ores and concentrates—							
Tons	7,361,473	1,231,468	270,006	[2] 128,119	345	744,929	4,986,606
Cost	$60,402,094	$8,398,494	$826,031	$16,347,513	$5,104	$3,468,371	$31,356,581
Matte, purchased—							
Tons	29,265	3,349			2,796	5,488	17,632
Cost	$4,135,742	$387,351			$14,160	$204,933	$3,529,298
Blister or anodes, purchased—							
Tons	372,607			9,000	169,435		194,172
Cost	$111,248,191			$2,052,000	$57,824,166		$51,372,025
Flux and other materials operated upon	$5,783,984	$373,194	$197,590	$38,141	$36,621	$88,474	$5,049,964
Fuel	$10,061,427	$2,866,294	$243,972	$296,726	$480,709	$1,018,479	$5,155,247
Rent of power and heat	$119,484		$23,400			$27,000	$69,084
Mill supplies	$621,653	$97,476	$2,979	$2,947	$12,870	$107,278	$398,108
All other materials	$2,572,563	$244,224	$24,000	$70,374	$409,893	$219,464	$1,604,608
Freight	$1,791,848	$119,749			$28,467		$1,643,632
Products, aggregate value	$240,780,216	$22,761,981	$2,583,524	$21,222,217	$62,795,613	$8,498,956	$122,917,925
Smelters, total value	$88,374,830	$22,697,806	$2,583,524			$8,488,088	$54,605,412
Fine copper contents—							
Pounds	620,872,420	187,593,252	19,572,025			39,834,080	373,873,063
Value	$69,606,496	$21,149,788	$1,973,842			$4,351,061	$42,131,805
Silver—							
Ounces fine	21,945,304	1,371,762	558,883			3,363,431	16,651,228
Value	$12,274,779	$789,968	$318,684			$1,919,819	$9,246,308
Gold—							
Ounces fine	321,747	37,629	14,550			109,270	160,298
Value	$6,493,555	$758,050	$290,998			$2,217,208	$3,227,299
Amount received for contract work[3]	$117,680					$38,670	$79,010

[1] Includes establishments distributed as follows: Colorado, 3; Idaho, 1; Maryland, 1; Montana, 5; New York, 2; Oregon, 1; Tennessee, 2; Virginia, 1; Washington, 1.

[2] "Mineral."

[3] Not included in the total or aggregate value.

TABLE 17.—COPPER SMELTING AND REFINING—DETAILED SUMMARY, BY STATES AND TERRITORIES: 1905—Con.

	United States.	Arizona.	California.	Michigan.	New Jersey.	Utah.	All other states.
Products—Continued.							
Refineries and smelters combined with refineries, total value	$149,711,214	$2,775		$21,222,217	$61,585,537		$66,900,685
Ingots, bars, wire, etc.—							
Pounds	933,809,701			173,287,133	332,855,640		427,666,928
Value	$119,420,862			$21,217,267	$42,907,595		$55,296,000
Silver—							
Ounces fine	28,115,790			9,000	19,241,470		8,865,320
Value	$16,034,886			$4,950	$10,999,568		$5,030,368
Gold—							
Ounces fine	636,207				356,700		279,507
Value	$13,135,098				$7,371,514		$5,763,584
Blue vitriol—							
Pounds	27,729,900	56,151			7,645,949		20,027,800
Value	$1,120,368	$2,775			$306,860		$810,733
All other products	$2,694,172	$61,400			$1,210,076	$10,868	$1,411,828
Amount received for contract work[1]	$4,806,039				$1,091,454		$3,714,585
Power:							
Number of establishments reporting	37	7	3	3	3	4	17
Total horsepower	85,828	20,245	2,714	546	5,575	3,173	53,575
Owned—							
Engines—							
Steam—							
Number	320	60	10	13	22	11	204
Horsepower	61,402	13,999	1,850	460	5,295	1,690	38,108
Gas and gasoline—							
Number	19	16	1				2
Horsepower	1,274	1,205	44				25
Water wheels—							
Number	21	4					17
Horsepower	9,400	95					9,305
Electric motors—							
Number	331	115	12	5	54	4	141
Horsepower	9,304	4,596	270	86	280	50	4,022
Other power, horsepower	1,333	350				983	
Rented—							
Electric motors—							
Number	70		16			25	29
Horsepower	3,115		550			450	2,115
Furnished to other establishments, horsepower	956	800			140		16

[1] Not included in the total or aggregate value.

LEAD SMELTING AND REFINING.

The general statistics of the lead smelting industry are shown in Table 18 for the censuses of 1900 and 1905, and the per cent of increase of the various items.

TABLE 18.—*Lead smelting and refining—comparative summary, with per cent of increase: 1905 and 1900.*

	CENSUS.		Per cent of increase.
	1905	1900	
Number of establishments	32	39	[1]17.9
Capital	$63,822,810	$72,148,933	[1]11.5
Salaried officials, clerks, etc., number	524	425	23.3
Salaries	$887,602	$754,913	17.6
Wage-earners, average number	7,573	8,319	[1]9.0
Total wages	$5,374,691	$5,088,684	5.6
Men 16 years and over	7,566	8,312	[1]9.0
Wages	$5,371,031	$5,086,704	5.6
Women 16 years and over	7		
Wages	$3,660		
Children under 16 years		7	
Wages		$1,980	
Miscellaneous expenses	$897,876	$1,166,210	[1]23.0
Cost of materials used	$168,958,076	$144,195,163	17.2
Value of products	$185,826,839	$175,466,304	5.9

[1] Decrease.

Table 18 includes only active establishments. In addition there were 3 idle establishments reported at the census of 1905, located 1 in California, 1 in Colorado, and 1 in New Mexico, which reported capital investment and power equipment as follows:

TABLE 19.—*Lead smelting and refining—idle establishments: 1905.*

Number of establishments	3
Capital, total	$326,400
Land	$6,800
Buildings	$152,600
Machinery, tools, and implements	$167,000
Power owned:	
Number of establishments reporting	3
Total horsepower	965
Engines, steam—	
Number	5
Horsepower	665
Electric motors—	
Number	3
Horsepower	300

At the census of 1900 there were 3 idle establishments with a capital of $629,871, located 1 in Missouri, 1 in Nevada, and 1 in Utah.

The statistics compiled at the census of 1890 were not in conformity with the methods followed in compiling the statistics for manufactures for 1900 and 1905, and therefore can not be used for purposes of comparison, but Table 20 shows the totals for the lead smelting and refining works as reported at that census.

TABLE 20.—*Lead smelting and refining: 1890.*

Expenditures, total	$11,457,367
Wages	$4,228,634
Salaries	$510,716
Supplies and materials	$5,154,682
Rent, insurance, taxes, etc	$1,489,715
Contractors	$73,620
Number of employees:	
Office force	249
Foremen	173
Mechanics	354
Laborers	5,595
Boys	9
Average daily wages:	
Foremen	$3.98
Mechanics	$2.93
Laborers	$2.15
Boys	$0.50
Average days employed:	
Foremen	337
Mechanics	322
Laborers	307
Boys	336
Products:	
Refined lead (tons)	182,967
Fine copper in matte (pounds)	4,195,929
Stock:	
Base bullion (tons), January 1, 1889	1,474
Base bullion (tons), January 1, 1890	4,730
Refined lead (tons), January 1, 1889	12,058
Refined lead (tons), January 1, 1890	9,230

The lead product reported at the census of 1900, as compared with that of 1890, increased 60.7 per cent, and at the census of 1905 as compared with that of 1900, 33.2 per cent. On account of the different methods of treating the smelting industry prior to 1890, census figures comparable with those for 1900 and 1905 are not available, but the statistics of lead production, as compiled by the Geological Survey since 1873, are presented in Table 21.

TABLE 21.—*Production of refined lead in the United States: 1873 to 1904.*[1]

YEAR.	Total (tons).	Desilverized lead (tons).	Soft lead (tons).
1904	404,453	315,284	89,169
1903	378,518	295,074	83,444
1902	377,061	303,011	74,050
1901	381,688	323,790	57,898
1900	377,679	329,658	48,021
1899	304,392	263,826	40,566
1898	310,621	267,842	42,779
1897	291,036	247,483	43,553
1896	264,994	221,457	43,537
1895	241,882	201,992	39,890
1894	219,090	181,404	37,686
1893	229,333	196,820	32,513
1892	213,262	181,584	31,678
1891	202,406	171,009	31,397
1890	161,754	130,403	31,351
1889	182,967	153,709	29,258
1888	180,555	151,465	29,090
1887	160,700	135,552	25,148
1886	135,629	114,829	20,800
1885	129,412	107,437	21,975
1884	139,897	119,965	19,932

[1] United States Geological Survey, "Mineral Resources of the United States," 1904 and 1900.

TABLE 21.—*Production of refined lead in the United States: 1873 to 1904*—Continued.

YEAR.	Total (tons).	Desilverized lead (tons).	Soft lead (tons).
1883	143,957	122,157	21,800
1882	132,890	103,875	29,015
1881	117,085	86,315	30,770
1880	97,825	70,135	27,690
1879	92,780	64,650	28,130
1878	91,060	64,290	26,770
1877	81,900	50,748	31,152
1876	64,070	37,649	26,421
1875	59,640	34,909	24,731
1874	52,080		
1873	42,540	20,159	22,381

The total production of refined lead as reported at the census of 1905 is 391,530 tons, or 12,923 tons less than the total shown for the calendar year 1904 in Table 21, due chiefly to the fact that the periods covered are not identical. The returns of the Geological Survey are for the calendar year, while the reports for the Census Office cover the fiscal year of the corporations reporting, which in only a few cases is the calendar year.

The production of refined lead, as shown by the Census reports, is given in Table 22 for the censuses of 1900 and 1905. To avoid disclosing individual operations, statistics by states can be shown only for Missouri in this and all other detailed tables.

TABLE 22.—*Lead smelting and refining—production of refined lead, by states: 1905 and 1900.*

STATE.	Census.	Total (tons).	Soft lead (tons).	Hard or antimonial lead (tons).	All other lead, including Dorébars (tons).
United States	1905	391,530	84,864	11,953	294,713
	1900	293,965	45,237	8,393	240,335
Missouri	1905	53,840	53,840		
	1900	41,976	41,976		
All other states	[1] 1905	337,690	31,024	11,953	294,713
	[2] 1900	251,989	3,261	8,393	240,335

[1] Includes states as follows: California, Colorado, Idaho, Illinois, Iowa, Kansas, Montana, Nebraska, New Jersey, Pennsylvania, Texas, Utah, Washington, Wisconsin.

[2] Includes states as follows: California, Colorado, Idaho, Illinois, Iowa, Kansas, Montana, Nebraska, New Jersey, New Mexico, Texas, Utah, Virginia, Washington.

THE INDUSTRY, BY STATES.

Table 23 presents the general statistics by states for 1900 and 1905.

TABLE 23.—LEAD SMELTING AND REFINING—COMPARATIVE SUMMARY, BY STATES: 1905 AND 1900.

STATE.	Census.	Number of establishments.	Capital.	Salaried officials, clerks, etc.: Number.	Salaried officials, clerks, etc.: Salaries.	Wage-earners and wages: Average number.	Wage-earners and wages: Wages.	Miscellaneous expenses.	Cost of materials used.	Value of products.
United States	1905	32	$63,822,810	524	$887,602	7,573	$5,374,691	$897,876	[1] $168,958,076	[1] $185,826,839
	1900	39	72,148,933	425	754,913	8,319	5,088,684	1,166,210	[1] 169,703,366	[1] 200,974,507
Missouri	1905	8	1,341,292	41	79,977	489	275,912	64,486	4,683,846	5,473,586
	1900	11	944,539	35	47,360	474	255,590	41,565	3,317,558	3,852,435
All other states	[2] 1905	24	62,481,518	483	807,625	7,084	5,098,779	833,390	164,274,230	180,353,253
	[3] 1900	28	71,204,394	390	707,553	7,845	4,833,094	1,124,645	166,385,808	197,122,072

[1] Includes a duplication in cost of materials and value of products of $1,036,848 for 1905 and of $25,508,203 for 1900. The latter amount represents intermediate products between the ore and the refined metal.

[2] Includes establishments distributed as follows: California, 1; Colorado, 7; Idaho, 1; Illinois, 3; Iowa, 1; Kansas, 1; Montana, 1; Nebraska, 1; New Jersey, 2; Pennsylvania, 1; Texas, 1; Utah, 1; Washington, 2; Wisconsin, 1.

Table 24 presents the statistics for the establishments grouped according to location, east and west of the Mississippi river, for 1900 and 1905, with the respective per cents of increase.

TABLE 24.—LEAD SMELTING AND REFINING—COMPARATIVE SUMMARY OF ESTABLISHMENTS, BY LOCATION, EAST AND WEST OF THE MISSISSIPPI RIVER: 1905 AND 1900.

	TOTAL.		EAST OF THE MISSISSIPPI.		WEST OF THE MISSISSIPPI.		PER CENT OF INCREASE.		
	1905	1900	1905	1900	1905	1900	Total.	East.	West.
Number of establishments	32	39	7	5	25	34	[1]17.9	40.0	[1]26.5
Capital	$63,822,810	$72,148,933	$12,325,777	$8,975,079	$51,497,033	$63,173,854	[1]11.5	37.3	[1]18.5
Salaried officials, clerks, etc., number	524	425	102	36	422	389	23.3	183.3	8.5
Salaries	$887,602	$754,913	$157,595	$69,502	$730,007	$685,411	17.6	126.7	6.5
Wage-earners, average number	7,573	8,319	1,362	715	6,211	7,604	[1]9.0	90.5	[1]18.3
Total wages	$5,374,691	$5,088,684	$720,332	$453,787	$4,654,359	$4,634,897	5.6	58.7	0.4
Miscellaneous expenses	$897,876	$1,166,210	$304,709	$87,660	$593,167	$1,078,550	[1]23.0	247.6	[1]45.0
Materials used, aggregate cost [2]	$168,958,076	$169,703,366	$43,522,255	$32,963,166	$125,435,821	$136,740,200			
Smelting—									
Ores—									
Tons	2,412,005	1,952,459	104,119	13,385	2,307,886	1,939,074	23.5	677.9	19.0
Cost	$60,784,358	$60,868,480	$3,516,301	$1,208,568	$57,268,057	$59,659,912	[1]0.1	190.9	[1]4.0
Refining, total cost	$99,283,641	$100,802,504	$37,168,732	$30,688,133	$62,114,909	$70,114,371			
Doré bars—									
Ounces	13,147,523	(3)	6,055,516	(3)	7,092,007	(3)			
Cost	$31,722,604	(3)	$6,983,030	(3)	$24,739,574	(3)			
Domestic base bullion—									
Tons	239,836	180,998	73,952	45,000	165,884	135,998			
Cost	$49,883,791	$80,940,771	$13,690,516	$12,006,867	$36,193,275	$68,933,904			
Foreign base bullion—									
Tons	97,179	78,939	87,617	76,810	9,562	2,129			
Cost	$17,677,246	$19,861,733	$16,495,186	$18,681,266	$1,182,060	$1,180,467			
All other materials	$8,890,077	$8,032,382	$2,837,222	$1,066,465	$6,052,855	$6,965,917	10.7	166.0	[1]13.1
Products, aggregate value [2]	$185,826,839	$200,974,507	$46,933,641	$38,992,943	$138,893,198	$161,981,564			
Smelting, total value	$62,220,245	$77,061,277	$1,977,553	$1,482,583	$60,242,692	$75,578,694			
Nonargentiferous ores—									
Lead—									
Pounds	169,728,880	90,473,286	46,758,653	686,703	122,970,227	89,786,583	87.6	6,709.2	37.0
Value	$7,324,869	$3,801,242	$1,977,553	$29,610	$5,347,316	$3,771,632	92.7	6,578.7	41.8
Argentiferous ores, total value	$54,895,376	$73,260,035		$1,452,973	$54,895,376	$71,807,062			
Lead contents of base bullion—									
Pounds	449,935,104	402,324,605		1,523,330	449,935,104	400,801,275			
Value	$13,757,268	$15,546,661		$57,024	$13,757,268	$15,489,637			
Silver—									
Ounces fine	37,543,073	52,641,752		2,043,033	37,543,073	50,598,719			
Value	$21,322,494	$31,185,203		$1,217,369	$21,322,494	$29,967,834			
Gold—									
Ounces fine	965,048	1,322,177		8,825	965,048	1,313,352			
Value	$19,815,614	$26,528,171		$178,580	$19,815,614	$26,349,591			
Refining and desilverizing, total value	$117,452,682	$115,527,046	$44,912,506	$35,539,270	$72,540,176	$79,987,776	1.7	26.4	[1]9.3
Hard or antimonial lead—									
Pounds	23,905,398	16,785,097	10,802,331	6,286,000	13,103,067	10,499,097	42.4	71.8	24.8
Value	$925,117	$701,082	$391,486	$262,912	$533,631	$438,170	32.0	48.9	21.8
All other lead, including Doré bars—									
Pounds	589,426,558	480,670,834	294,818,919	226,852,000	294,607,639	253,818,834	22.6	30.0	16.1
Value	$22,107,915	$20,672,140	$10,094,782	$9,663,961	$12,013,133	$11,008,179	6.9	4.5	9.1
Doré bars and fine bars, total value	$94,419,650	$94,153,824	$34,426,238	$25,612,397	$59,993,412	$68,541,427	0.3	34.4	[1]12.5
Silver—									
Ounces fine	72,592,987	70,420,917	39,257,137	31,619,725	33,335,850	38,801,192	3.1	24.2	[1]14.1
Value	$41,425,114	$42,143,703	$22,621,331	$18,908,707	$18,803,783	$23,234,996	[1]1.7	19.6	[1]19.1
Gold—									
Ounces fine	2,574,549	2,514,836	571,120	325,141	2,003,429	2,189,695	2.4	75.7	[1]8.5
Value	$52,994,536	$52,010,121	$11,804,907	$6,703,690	$41,189,629	$45,306,431	1.9	76.1	[1]9.1
All other products, total value	$6,153,912	$8,386,184	$43,582	$1,971,090	$6,110,330	$6,415,094	[1]26.6	[1]97.8	[1]4.8
Copper in matte, etc.—									
Pounds	51,617,670	26,964,031		150,000	51,617,670	26,814,031	91.4		92.5
Value	$4,812,865	$3,768,402		$25,000	$4,812,865	$3,743,402	27.7		28.6
Copper sulphate—									
Pounds	11,371,251	(3)	797,323	(3)	10,573,928	(3)			
Value	$541,763	(3)	$41,301	(3)	$500,462	(3)			
Other products, value	$799,284	$4,617,782	$2,281	$1,946,090	$797,003	$2,671,692	[1]82.7	[1]99.9	[1]70.2
Including—									
Lead oxide, pounds	11,289,399	10,329,804			11,289,399	10,329,804	9.3		9.3
Arsenic, pounds	554,445	(3)		(3)	554,445	( )			

[1] Decrease.
[2] Includes a duplication in cost of materials and value of products of $1,036,848 for 1905, and $25,508,203 for 1900. The latter amount represents intermediate products between the ore and the refined metal.
[3] Not reported separately.

The decrease in the number of active establishments and in the capital invested, wage-earners employed, and general operating expense has all been in the West, the establishments located east of the Mississippi river showing an increase in all of these particulars. On account of the large duplication in cost of materials and value of products in the figures for 1900, which duplication represents the intermediate products of the smelting department in the case of establishments doing both smelting and refining, the detailed figures for materials and products are not in all cases comparable. Deducting the duplication of $1,036,848 for 1905, which all pertains to western establishments, and the duplication of $25,508,203 for 1900, of which amount $801,000 pertains to eastern smelters and the balance to western establishments, there is deduced a comparison of materials and products, as shown in Table 25.

TABLE 25.—LEAD SMELTING AND REFINING—COMPARATIVE SUMMARY OF MATERIALS AND PRODUCTS, NET COST AND VALUE, IN ESTABLISHMENTS, BY LOCATION, EAST AND WEST OF THE MISSISSIPPI RIVER: 1905 AND 1900.

	TOTAL.		EAST OF THE MISSISSIPPI.		WEST OF THE MISSISSIPPI.		PER CENT OF INCREASE.		
	1905	1900	1905	1900	1905	1900	Total.	East.	West.
Materials used, total cost	$167,921,228	$144,195,163	$43,522,255	$32,162,166	$124,398,973	$112,032,997	16.5	35.3	11.0
Products, aggregate value	184,789,991	175,466,304	46,933,641	38,191,943	137,856,350	137,274,361	5.3	22.9	0.4
Smelting	62,220,245	51,553,074	1,977,553	681,583	60,242,692	50,871,491	20.7	190.1	18.4
Refining and desilverizing	116,415,834	115,527,046	44,912,506	35,539,270	71,503,328	79,987,776	0.8	26.4	[1] 10.6
All other products	6,153,912	8,386,184	43,582	1,971,090	6,110,330	6,415,094	[1] 26.6	[1] 97.8	[1] 4.8

[1] Decrease.

In addition to the duplication before noted there is also the duplication arising from the refining of the product of the argentiferous smelters, when done by a separate refinery. In such cases the product of the smelters appears as material for a refinery, and materials and products are duplicated to this extent, but it is only where materials and products are included twice in the report for the same establishment that they are considered as duplications. The above comparison shows the greater increase in the eastern smelters.

The Missouri smelters handle nonargentiferous ores exclusively, and a comparison of the operating expenses for the censuses of 1890, 1900, and 1905 is presented in Table 26.

TABLE 26.—*Lead smelting and refining—statistics of Missouri smelters: 1890 to 1905.*

	1905	1900	1890 [1]	Per cent of increase, 1900 to 1905.
Total expenses	$650,123	$530,693	$580,210	22.5
Salaries	$79,977	$47,360	$19,680	68.9
Wages	$275,912	$255,590	$206,541	8.0
Miscellaneous expenses, not including contract work	$53,552	$41,565	$166,632	28.8
Amount received for contract work	$10,934	$25,382	$3,182	[2] 56.9
Cost of materials used, not including ore	$229,748	$160,796	$184,175	42.9
Quantity of ore treated (tons)	88,286	68,719	49,816	28.5
Lead produced (tons)	53,840	41,976	29,258	28.3
Oxide produced (tons)	5,645	5,165	1,250	9.3

[1] Includes the data for Illinois, Kansas, Missouri, Wisconsin.
[2] Decrease.

The average wage expense per ton of ore smelted was $3.13 for 1905, compared with $3.72 for 1900 and $4.15 for 1890.

MATERIALS USED.

Table 27 shows the quantities of ore and base bullion consumed by smelters and refineries as reported at the censuses of 1900 and 1905. The source of the base bullion, whether foreign or domestic, is shown, but the returns for the census of 1905 do not show the quantity of foreign ore consumed. In 1900 there were 284,914 tons of foreign ore and 1,667,545 tons of domestic.

TABLE 27.—*Lead smelting and refining—quantity of ore smelted and base bullion refined and desilverized, by states: 1905 and 1900.*

STATE.	Census.	Ore smelted (tons).	BASE BULLION REFINED AND DESILVERIZED.		
			Total (tons).	Domestic (tons).	Foreign (tons).
United States	1905	2,412,005	337,015	239,836	97,179
	1900	1,952,459	259,937	180,998	78,939
Missouri	1905	88,286			
	1900	68,719			
All other states	[1] 1905	2,323,719	337,015	239,836	97,179
	[2] 1900	1,883,740	259,937	180,998	78,939

[1] Includes states as follows: California, Colorado, Idaho, Illinois, Iowa, Kansas, Montana, Nebraska, New Jersey, Pennsylvania, Texas, Utah, Washington, Wisconsin.
[2] Includes states as follows: California, Colorado, Idaho, Illinois, Iowa, Kansas, Montana, Nebraska, New Jersey, New Mexico, Texas, Utah, Virginia, Washington.

The consumption of ore shows an increase of 459,546 tons, or 23.5 per cent, and base bullion purchased, an increase of 77,078 tons, or 29.7 per cent, the domestic base bullion increasing 58,838 tons, or 32.5 per cent, and foreign bullion 18,240 tons, or 23.1 per cent.

PRODUCTS.

Table 28 gives the quantity and the value of the different classes of products, and the number of establishments reporting each class for 1900 and 1905.

TABLE 28.—LEAD SMELTING AND REFINING—PRINCIPAL PRODUCTS, BY KIND, QUANTITY, AND VALUE, WITH NUMBER OF ESTABLISHMENTS REPORTING: 1905 AND 1900.

KIND.	Census.	Number of establishments reporting.	PRODUCTS. Unit of measure.	Quantity.	Value.
Smelting nonargentiferous ores:					
Soft lead	1905	16	Pound	169,728,880	$7,324,869
	1900	17	Pound	90,473,286	3,801,242
Smelting argentiferous ores:					
Lead contents of base bullion	1905	12	Pound	449,935,104	13,757,268
	1900	[1] 23	Pound	402,324,605	15,546,661
Silver	1905	12	Ounce fine	37,543,073	21,322,494
	1900	[1] 23	Ounce fine	52,641,752	31,185,203
Gold	1905	12	Ounce fine	965,048	19,815,614
	1900	[1] 22	Ounce fine	1,322,177	26,528,171
Copper contents of matte	1905	12	Pound	51,617,670	4,812,865
	1900	19	Pound	26,964,031	3,768,402
Refining and desilverizing:					
Hard or antimonial lead	1905	6	Pound	23,905,398	925,117
	1900	8	Pound	16,785,097	701,082
All other lead (including Doré bars)	1905	7	Pound	589,426,558	22,107,915
	1900	9	Pound	480,670,834	20,672,140
Doré bars and fine bars, silver	1905	7	Ounce fine	72,592,987	41,425,114
	1900	9	Ounce fine	70,420,917	42,143,703
Doré bars and fine bars, gold	1905	7	Ounce fine	2,574,549	52,994,536
	1900	9	Ounce fine	2,514,836	52,010,121

[1] Includes smelters combined with refineries and duplication of intermediate products between smelting and refining departments.

There were 16 establishments that engaged in smelting nonargentiferous ores in 1905 as compared with 17 in 1900, and 19 in smelting argentiferous ores in 1905 as compared with 23 in 1900. Seven of the 19 argentiferous smelters in 1905 did both smelting and refining, and hence are classed as refiners, making 12 establishments engaged in the smelting only of argentiferous ores.

A comparison of the lead, gold, and silver products, quantities and values, for 1900 and 1905, and the per cent of increase is shown in the following statement:

Lead smelting and refining—quantity and value of principal products, with per cent of increase: 1905 and 1900.

KIND.	PRODUCTS. Quantity. 1905	Quantity. 1900	Value. 1905	Value. 1900	PER CENT OF INCREASE. Quantity.	Value.
Total			$124,777,551	$119,328,288		4.6
Lead, total (pounds)	783,060,836	587,929,217	30,357,901	25,174,464	33.2	20.6
Soft	169,728,880	90,473,286	7,324,869	3,801,242	87.6	92.7
Hard or antimonial	23,905,398	16,785,097	925,117	701,082	42.4	32.0
All other	589,426,558	480,670,834	22,107,915	20,672,140	22.6	6.9
Gold and silver (ounces fine)			94,419,650	94,153,824		0.3
Gold	2,574,549	2,514,836	52,994,536	52,010,121	2.4	1.9
Silver	72,592,987	70,420,917	41,425,114	42,143,703	3.1	[1] 1.7

[1] Decrease.

The heavy increase in the consumption of dry ores by the copper smelters has been at the expense of the lead smelters and is shown in the relative decrease of the silver and gold products of this industry. The hard or antimonial lead and "all other" lead represents the lead product of the argentiferous smelters and the lead smelters handling dry ores.

The increase in the combined product of hard or antimonial lead and "all other" lead for 1900 and 1905 was 23.3 per cent, while the increase in the silver

and gold product, measured by quantities, was very small.

This marked change is not due in the case of the lead smelters to a falling off in the precious metal values of the argentiferous lead ores treated, nor in the case of the copper smelters to a general increase in the precious metal values of the copper ores handled, but it results from the large increase in the quantity of dry gold and silver ores handled by the latter.

Table 29 presents the quantities of the different varieties of products, for Missouri and "all other states," for 1900 and 1905.

TABLE 29.—LEAD SMELTING AND REFINING—PRINCIPAL PRODUCTS, BY KIND AND QUANTITY, AND BY STATES: 1905 AND 1900.

STATE.	Census.	SMELTING.						REFINING AND DESILVERIZING.			
		Nonargentiferous ores.		Argentiferous ores.				Hard or antimonial lead (pounds).	All other lead, including Doré bars (pounds).	Doré bars, contents of precious metals, and fine bars.	
		Soft lead (pounds).	Lead oxide (pounds).	Lead contents of base bullion (pounds).	Silver (ounces fine).	Gold (ounces fine).	Copper contents of matte (pounds).			Silver (ounces fine).	Gold (ounces fine).
United States	1905	169,728,880	11,289,399	449,935,104	37,543,073	965,048	51,617,670	23,905,398	589,426,558	72,592,987	2,574,549
	1900	90,473,286	10,329,804	402,324,605	52,641,752	1,322,177	26,964,031	16,785,097	480,670,834	70,420,917	2,514,836
Missouri	1905	107,680,403	11,289,399				48,000				
	1900	83,952,833	10,329,804								
All other states	[1]1905	62,048,477		449,935,104	37,543,073	965,048	51,569,670	23,905,398	589,426,558	72,592,987	2,574,549
	[2]1900	6,520,453		402,324,605	52,641,752	1,322,177	26,964,031	16,785,097	480,670,834	70,420,917	2,514,836

[1] Includes states as follows: California, Colorado, Idaho, Illinois, Iowa, Kansas, Montana, Nebraska, New Jersey, Pennsylvania, Texas, Utah, Washington, Wisconsin.
[2] Includes states as follows: California, Colorado, Idaho, Illinois, Iowa, Kansas, Montana, Nebraska, New Jersey, New Mexico, Texas, Utah, Virginia, Washington.

The location of the dry gold and silver ores and cheap fuel have been the chief factors which have influenced the location of the lead smelters.

The Missouri smelters are the largest producers of soft lead. The product of the state increased 23,727,570 pounds in 1905 over 1900, or 28.3 per cent; its output constituting 63.4 per cent of the total product of 1905 as compared with 92.8 per cent in 1900. The large increase in the soft lead product of the Illinois and Kansas smelters operates to lower the proportional share of the Missouri smelters.

Missouri also manufactured the entire product of lead oxide reported at both censuses. While the bulk of the smelting of argentiferous ores centers in Colorado, Utah, Washington, Texas, and Montana, in the order named, the refining and desilverizing is located in California, Nebraska, New Jersey, Illinois, and Washington. Idaho is the largest producer of lead ores, outranking Utah, Colorado, and the soft lead states of the Mississippi valley, but its argentiferous lead ores are shipped to smelters in other states and a very small amount is smelted within the state.

PROCESS EMPLOYED—SMELTING, AND SMELTING AND REFINING.

Table 30 presents the statistics for all establishments for 1900 and 1905, segregated according to those doing smelting only and those doing smelting and refining—the latter including refining only—with the per cent of increase.

As before noted there is included in materials and products the duplication arising from the intermediate product between the ore and the refined metal being reported in certain cases by establishments doing both smelting and refining, this intermediate product appearing as product of the smelting department and as material for the refining department.

The group of establishments doing only smelting shows a large increase in capital, while the smelting and refining shows a decrease from 1900 to 1905. With respect to wage-earners there is a decrease in each group, with the larger proportional decrease in the smelting and refining group.

TABLE 30.—LEAD SMELTING AND REFINING—ESTABLISHMENTS CLASSIFIED ACCORDING TO PROCESS EMPLOYED, WITH PER CENT OF INCREASE: 1905 AND 1900.

	TOTAL.		SMELTING.		SMELTING AND REFINING.		PER CENT OF INCREASE.		
	1905	1900	1905	1900	1905	1900	Total.	Smelting.	Smelting and refining.
Number of establishments	32	39	25	30	7	9	[1]17.9	[1]16.7	[1]22.2
Capital	$63,822,810	$72,148,933	$32,677,874	$21,796,609	$31,144,936	$50,352,324	[1]11.5	49.9	[1]38.1
Salaried officials, clerks, etc., number	524	425	315	225	209	200	23.3	40.0	4.5
Salaries	$887,602	$754,913	$554,678	$427,000	$332,924	$327,913	17.6	29.9	1.5
Wage-earners, average number	7,573	8,319	5,477	5,635	2,096	2,684	[1]9.0	[1]2.8	[1]21.9
Total wages	$5,374,691	$5,088,684	$4,050,936	$3,209,779	$1,323,755	$1,878,905	5.6	26.2	[1]29.5
Miscellaneous expenses	$897,876	$1,166,210	$536,323	$730,773	$361,553	$435,437	[1]23.0	[1]26.6	[1]17.0
Materials used, aggregate cost [2]	$168,958,076	$169,703,366	$56,537,817	$42,875,982	$112,420,259	$126,827,384			
Smelting, ore—									
Tons	2,412,005	1,952,459	2,262,743	1,496,065	149,262	456,394	23.5	51.2	[1]67.3
Cost	$60,784,358	$60,868,480	$52,349,372	$38,738,064	$8,434,986	$22,130,416	[1]0.1	35.1	[1]61.9
Refining, total cost	$99,283,641	$100,802,504			$99,283,641	$100,802,504			
Doré bars—									
Ounces	13,147,523	(3)			13,147,523	(3)			
Cost	$31,722,604	(3)			$31,722,604	(3)			
Domestic base bullion—									
Tons	239,836	180,998			239,836	180,998			
Cost	$49,883,791	$80,940,771			$49,883,791	$80,940,771			
Foreign base bullion—									
Tons	97,179	78,939			97,179	78,939			
Cost	$17,677,246	$19,861,733			$17,677,246	$19,861,733			
All other materials	$8,890,077	$8,032,382	$4,188,445	$4,137,918	$4,701,632	$3,894,464	10.7	1.2	20.7
Products, aggregate value [2]	$185,826,839	$200,974,507	$67,341,324	$50,696,417	$118,485,515	$150,278,090			
Smelting, total value	$62,220,245	$77,061,277	$62,220,245	$47,328,485		$29,732,792			
Nonargentiferous ores, total value	$7,324,869	$3,801,242	$7,324,869	$3,624,668		$176,574			
Lead—									
Pounds	169,728,880	90,473,286	169,728,880	86,009,974		4,463,312	87.6	97.3	
Value	$7,324,869	$3,801,242	$7,324,869	$3,624,668		$176,574	92.7	102.1	
Argentiferous ores, total value	$54,895,376	$73,260,035	$54,895,376	$43,703,817		$29,556,218			
Lead contents of base bullion—									
Pounds	449,935,104	402,324,605	449,935,104	283,305,467		119,019,138			
Value	$13,757,268	$15,546,661	$13,757,268	$10,594,433		$4,952,228			
Silver—									
Ounces fine	37,543,073	52,641,752	37,543,073	33,071,356		19,570,396			
Value	$21,322,494	$31,185,203	$21,322,494	$19,701,888		$11,483,315			
Gold—									
Ounces fine	965,048	1,322,177	965,048	676,035		646,142			
Value	$19,815,614	$26,528,171	$19,815,614	$13,407,496		$13,120,675			
Refining and desilverizing, total value	$117,452,682	$115,527,046			$117,452,682	$115,527,046	1.7		1.7
Hard or antimonial lead—									
Pounds	23,905,398	16,785,097			23,905,398	16,785,097	42.4		42.4
Value	$925,117	$701,082			$925,117	$701,082	32.0		32.0
All other lead, including Doré bars—									
Pounds	589,426,558	480,670,834			589,426,558	480,670,834	22.6		22.6
Value	$22,107,915	$20,672,140			$22,107,915	$20,672,140	6.9		6.9
Doré and fine bars, total value	$94,419,650	$94,153,824			$94,419,650	$94,153,824	0.3		0.3
Silver—									
Ounces fine	72,592,987	70,420,917			72,592,987	70,420,917	3.1		3.1
Value	$41,425,114	$42,143,703			$41,425,114	$42,143,703	[1]1.7		[1]1.7
Gold—									
Ounces fine	2,574,549	2,514,836			2,574,549	2,514,836	2.4		2.4
Value	$52,994,536	$52,010,121			$52,994,536	$52,010,121	1.9		1.9
Doré bars, total value	$1,145,309	(3)			$1,145,309	(3)			
Silver—									
Ounces fine	841,234	(3)			841,234	(3)			
Value	$500,476	(3)			$500,476	(3)			
Gold—									
Ounces fine	31,240	(3)			31,240	(3)			
Value	$644,833	(3)			$644,833	(3)			
Fine bars, total value	$93,274,341	(3)			$93,274,341	(3)			
Silver—									
Ounces fine	71,751,753	(3)			71,751,753	(3)			
Value	$40,924,638	(3)			$40,924,638	(3)			
Gold—									
Ounces fine	2,543,309	(3)			2,543,309	(3)			
Value	$52,349,703	(3)			$52,349,703	(3)			
All other products, total value	$6,153,912	$8,386,184	$5,121,079	$3,367,932	$1,032,833	$5,018,252	[1]26.6	52.1	[1]79.4
Copper in matte, etc.—									
Pounds	51,617,670	26,964,031	47,522,080	20,467,894	4,095,590	6,496,137	91.4	132.2	[1]37.0
Value	$4,812,865	$3,768,402	$4,336,902	$2,785,010	$475,963	$983,392	27.7	55.7	[1]51.6
Copper sulphate—									
Pounds	11,371,251	(3)		(3)	11,371,251	(3)			
Value	$541,763	(3)		(3)	$541,763	(3)			
Other products, value	$799,284	$4,617,782	$784,177	$582,922	$15,107	$4,034,860	[1]82.7	34.5	[1]99.6
Including—									
Lead oxide (pounds)	11,289,399	10,329,804	11,289,399	10,329,804			9.3	9.3	
Arsenic (pounds)	554,445	(3)		(3)	554,445	(3)			

[1] Decrease.
[2] Includes a duplication in cost of materials and value of products of $1,036,848 for 1905 and $25,508,203 for 1900. The latter amount represents intermediate products between the ore and the refined metal.
[3] Not reported separately.

If correction is made for the duplication due to intermediate products the comparative figures for materials and products are as given in Table 31.

TABLE 31.—LEAD SMELTING AND REFINING—COMPARATIVE SUMMARY OF MATERIALS AND PRODUCTS, NET COST AND VALUE, CLASSIFIED ACCORDING TO PROCESS EMPLOYED: 1905 AND 1900.

	TOTAL.		SMELTING.		SMELTING AND REFINING.		PER CENT OF INCREASE.		
	1905	1900	1905	1900	1905	1900	Total.	Smelting.	Smelting and refining.
Materials used, total cost	$167,921,228	$144,195,163	$56,537,817	$42,875,982	$111,383,411	$101,319,181	16.5	31.9	9.9
Products, aggregate value	184,789,991	175,466,304	67,341,324	50,696,417	117,448,667	124,769,887	5.3	32.8	[1] 5.9
Smelting	62,220,245	51,553,074	62,220,245	47,328,485		4,224,589	20.7	31 5	
Refining and desilverizing	116,415,834	115,527,046			116,415,834	115,527,046	0.8		0.8
All other products	6,153,912	8,386,184	5,121,079	3,367,932	1,032,833	5,018,252	[1] 26.6	52.1	[1] 79.4

[1] Decrease.

GROSS AND NET VALUES OF PRODUCTS.

In making the canvass for the census of 1905 inquiries were made as to the expense of marketing the product of the smelters, in order to show the gross and net values of the smelter products. This expense consists of tolls paid for refining, freight on bullion, matte, or other smelter product to the refining or desilverizing establishment, treating the smelter product, and commissions and selling expenses. In the prior tables the values of products have been net values. Table 32 presents the statistics bearing on gross and net values and the deductions reported.

TABLE 32.—LEAD SMELTING AND REFINING—ESTABLISHMENTS REPORTING GROSS AND NET VALUES OF PRODUCTS: 1905.

	Total.	SMELTERS ONLY.		Refineries and desilverizers, including smelters connected with refineries.
		Nonargentiferous.	Argentiferous.	
All establishments:				
Number	32	13	12	7
Products, net value	$185,826,839	$8,112,956	$59,228,368	$118,485,515
Establishments reporting gross and net values:				
Number	20	4	12	4
Total products, net value	$148,609,966	$2,801,464	$59,228,368	$86,580,134
Products not charged with deductions	$93,602,178		$21,779,657	$71,822,521
Products charged with deductions—				
Gross value	$62,086,584	$2,857,672	$43,605,940	$15,622,972
Net value	$55,007,788	$2,801,464	$37,448,711	$14,757,613
Total deductions on bullion and matte products, for refining, freight, commissions, etc.	$7,078,796	$56,208	$6,157,229	$865,359
Tolls paid for refining	$3,825,208		$3,792,067	$33,141
Freight	$3,216,093	$51,927	$2,331,948	$832,218
Commissions and selling expenses [1]	$37,495	$4,281	$33,214	
Lead—				
Number	19	4	12	3
Gross value	$35,730,921	$2,857,672	$18,194,013	$14,679,236
Net value	$30,432,176	$2,801,464	$13,757,268	$13,873,444
Deductions	$5,298,745	$56,208	$4,436,745	$805,792
Tolls paid for refining	$2,279,834		$2,279,834	
Freight	$3,003,742	$51,927	$2,146,023	$805,792
Commissions and selling expenses	$15,169	$4,281	$10,888	
Silver—				
Number	3		2	1
Gross value	$1,047,190		$1,022,796	$24,394
Net value	$1,027,610		$1,004,923	$22,687
Deductions, tolls paid for refining	$19,580		$17,873	$1,707
Gold—				
Number	10		9	1
Gross value	$18,486,177		$18,482,320	$3,857
Net value	$18,357,260		$18,353,528	$3,732
Deductions, tolls paid for refining	$128,917		$128,792	$125
Copper—				
Number	13		9	4
Gross value	$6.822,296		[2] $5,906,811	[3] $915,485
Net value	$5,190,742		[2] $4,332,992	[3] $857,750
Deductions	$1,631,554		$1,573,819	$57,735
Tolls paid for refining	$1,396,877		$1,365,568	$31,309
Freight	$212,351		$185,925	$26,426
Commissions and selling expenses	$22,326		$22,326	
All other establishments:				
Number	12	9		3
Products	$37,216,873	$5,311,492		$31,905,381

[1] Commissions and selling expenses reported by 4 smelting establishments—3 nonargentiferous and 1 argentiferous.
[2] Gross value: Copper contents of matte, $5,906,311; other products, $500. Net value: Copper contents of matte, $4,332,502; other products, $490.
[3] Gross value: Copper and copper contents of matte, $516,859; blue vitriol, $398,626. Net value: Copper and copper contents of matte, $475,963; blue vitriol, $381,787.

Of the 32 establishments there were 20 reporting gross and net values, 4 of these being nonargentiferous smelters, 12 argentiferous smelters, and 4 refineries or smelters and refineries. The gross value of the products charged with deductions was $62,086,584, against which the deductions were $7,078,796, leaving $55,-007,788 as the net value of the same. The 20 establishments reporting deductions had products of a value of $93,602,178 not charged with deductions, and the remaining 12 establishments had products amounting to $37,216,873, making a total of $130,819,051 of products not charged with the expense of subsequent treatment. In the case of the few nonargentiferous smelters reporting deductions they are entirely for freight and selling expense. The bulk of the deductions pertain to the bullion and matte products of the argentiferous smelters. The lead contents of the base bullion product of the argentiferous smelters amounted to 449,935,104 pounds and the tolls paid for refining were $3,792,067 and freight to refineries $2,331,948.

The detailed statistics for the lead smelting and refining industry at the census of 1905 are shown in Table 33. The amount received for contract smelting and refining is given, but the ores thus treated are included in the quantities and values of the materials and products.

TABLE 33.—*Lead smelting and refining—detailed summary, by states: 1905.*

	United States.	Missouri.	All other states.[1]
Number of establishments	32	8	24
Capital, total	$63,822,810	$1,341,292	$62,481,518
Land	$2,958,080	$58,000	$2,900,080
Buildings	$18,628,976	$160,200	$18,468,776
Machinery, tools, and implements	$20,941,814	$409,500	$20,532,314
Cash and sundries	$21,293,940	$713,592	$20,580,348
Proprietors and firm members	5	....	5
Salaried officials, clerks, etc.:			
Total number	524	41	483
Total salaries	$887,602	$79,977	$807,625
Officers of corporations—			
Number	18	8	10
Salaries	$78,027	$40,627	$37,400
General superintendents, managers, clerks, etc.—			
Total number	506	33	473
Total salaries	$809,575	$39,350	$770,225
Men—			
Number	498	33	465
Salaries	$802,595	$39,350	$763,245
Women—			
Number	8	....	8
Salaries	$6,980	....	$6,980
Wage-earners, including pieceworkers, and total wages:			
Greatest number employed at any one time during the year	8,342	533	7,809
Least number employed at any one time during the year	6,695	391	6,304
Average number	7,573	489	7,084
Total wages	$5,374,691	$275,912	$5,098,779
Men 16 years and over—			
Average number	7,566	489	7,077
Wages	$5,371,031	$275,912	$5,095,119
Women 16 years and over—			
Average number	7	....	7
Wages	$3,660	....	$3,660
Average number of wage-earners, including pieceworkers, employed during each month:			
Men 16 years and over—			
January	7,522	492	7,030
February	7,654	497	7,157
March	7,771	491	7,280
April	7,609	492	7,117
May	7,265	481	6,784
June	7,493	480	7,013
July	7,502	476	7,026
August	7,571	485	7,086
September	7,565	486	7,079
October	7,493	491	7,002

[1] Includes establishments distributed as follows: California, 1; Colorado, 7; Idaho, 1; Illinois, 3; Iowa, 1; Kansas, 1; Montana, 1; Nebraska, 1; New Jersey, 2; Pennsylvania, 1; Texas, 1; Utah, 1; Washington, 2; Wisconsin, 1.

TABLE 33.—*Lead smelting and refining—detailed summary, by states: 1905*—Continued.

	United States.	Missouri.	All other states.
Average number of wage-earners, including pieceworkers, employed during each month—Continued.			
Men 16 years and over—Continued.			
November	7,580	496	7,084
December	7,767	501	7,266
Women 16 years and over—			
January	9	....	9
February	8	....	8
March	6	....	6
April	7	....	7
May	7	....	7
June	7	....	7
July	8	....	8
August	7	....	7
September	7	....	7
October	6	....	6
November	6	....	6
December	6	....	6
Miscellaneous expenses, total	$897,876	$64,486	$833,390
Rent of works	$1,200	....	$1,200
Taxes	$115,030	$6,601	$108,429
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$743,712	$46,951	$696,761
Contract work	$37,934	$10,934	$27,000
Materials used, aggregate cost	$168,958,076	$4,683,846	$164,274,230
Smelting, total cost	$66,861,509	$4,657,403	$62,204,106
Ores—			
Tons	2,412,005	88,286	2,323,719
Cost	$60,784,358	$4,427,655	$56,356,703
Argentiferous—			
Tons	2,271,724	....	2,271,724
Cost	$53,934,731	....	$53,934,731
Nonargentiferous—			
Tons	140,281	88,286	51,995
Cost	$6,849,627	$4,427,655	$2,421,972
Fluxes—			
Tons	487,317	16,000	471,317
Cost	$615,703	$24,166	$591,537
Fuel	$3,019,972	$162,188	$2,857,784
Rent of power and heat	$27,366	....	$27,366
Mill supplies	$62,357	$21,394	$40,963
All other materials	$2,351,753	$22,000	$2,329,753
Refining and desilverizing, total cost	$101,890,582	....	$101,890,582
Doré bars—			
Ounces	13,147,523	....	13,147,523
Cost	$31,722,604	....	$31,722,604
Base bullion—			
Pounds	674,031,114	....	674,031,114
Cost	$67,561,037	....	$67,561,037
Domestic—			
Pounds	479,672,346	....	479,672,346
Cost	$49,883,791	....	$49,883,791
Foreign—			
Pounds	194,358,768	....	194,358,768
Cost	$17,677,246	....	$17,677,246
Fuel	$772,297	....	$772,297
Mill supplies	$36,041	....	$36,041
All other materials	$1,798,603	....	$1,798,603
Freight	$205,985	$26,443	$179,542
Products, aggregate value	$185,826,839	$5,473,586	$180,353,253
Smelting, total value	$67,341,324	$5,473,586	$61,867,738
Nonargentiferous ores, total value	$8,112,956	$5,473,586	$2,639,370
Soft lead—			
Pounds	169,728,880	107,680,403	62,048,477
Value	$7,324,869	$4,685,499	$2,639,370
All other products of nonargentiferous ores[2]	$788,087	$788,087	....
Amount received for contract work on nonargentiferous ores[3]	$170,000	....	$170,000
Argentiferous ores, total value	$59,228,368	....	$59,228,368
Lead contents of base bullion—			
Pounds	449,935,104	....	449,935,104
Value	$13,757,268	....	$13,757,268
Silver—			
Ounces fine	37,543,073	....	37,543,073
Value	$21,322,494	....	$21,322,494
Gold—			
Ounces fine	965,048	....	965,048
Value	$19,815,614	....	$19,815,614
All other products of argentiferous ores	$4,332,992	....	$4,332,992
Amount received for contract work on argentiferous ores[3]	$390,910	....	$390,910
Refining and desilverizing, total value	$118,485,515	....	$118,485,515
Hard or antimonial lead—			
Pounds	23,905,398	....	23,905,398
Value	$925,117	....	$925,117
All other lead (including Doré bars)—			
Pounds	589,426,558	....	589,426,558
Value	$22,107,915	....	$22,107,915
Doré bars, contents of precious metals—			
Silver—			
Ounces fine	841,234	....	841,234
Value	$500,476	....	$500,476
Gold—			
Ounces fine	31,240	....	31,240
Value	$644,833	....	$644,833

[2] Includes the value of 11,289,399 pounds of sublimed white lead.
[3] Not included in the total or aggregate value.

TABLE 33.—*Lead smelting and refining—detailed summary, by states: 1905*—Continued.

	United States.	Missouri.	All other states.
Products—Continued.			
Refining and desilverizing—Cont'd.			
Fine bars—			
Silver—			
Ounces fine	71,751,753		71,751,753
Value	$40,924,638		$40,924,638
Gold—			
Ounces fine	2,543,309		2,543,309
Value	$52,349,703		$52,349,703
All other products of refining and desilverizing	$1,032,833		$1,032,833
Amount received for contract work on refining and desilverizing [1]	$253,918		$253,918
Contents of foreign ores treated:			
Imported for consumption, total—			
Lead (pounds)	263,471		263,471
Silver (ounces fine)	7,979,912		7,979,912
Gold (ounces fine)	173,660		173,660
Copper (pounds)	12,395,603		12,395,603
From Mexico—			
Lead (pounds)	233,302		233,302
Silver (ounces fine)	7,128,713		7,128,713
Gold (ounces fine)	55,463		55,463
Copper (pounds)	388,840		388,840
From British Columbia—			
Silver (ounces fine)	531,338		531,338
Gold (ounces fine)	108,562		108,562
Copper (pounds)	11,968,045		11,968,045
From other countries—			
Lead (pounds)	30,169		30,169
Silver (ounces fine)	319,861		319,861
Gold (ounces fine)	9,635		9,635
Copper (pounds)	38,718		38,718
Smelted and refined in bond and re-exported, total—			
Lead (pounds)	107,647,481		107,647,481
Silver (ounces fine)	6,469,281		6,469,281
Gold (ounces fine)	36,543		36,543
Copper (pounds)	8,592,275		8,592,275
From Mexico—			
Lead (pounds)	105,683,586		105,683,586
Silver (ounces fine)	4,686,068		4,686,068
Gold (ounces fine)	34,460		34,460
Copper (pounds)	7,805,580		7,805,580
From Bolivia and all other countries—			
Lead (pounds)	1,963,895		1,963,895
Silver (ounces fine)	1,783,213		1,783,213
Gold (ounces fine)	2,083		2,083
Copper (pounds)	786,695		786,695
Power:			
Number of establishments reporting	30	6	24
Total horsepower	32,648	1,357	31,291
Owned—			
Engines—			
Steam—			
Number	169	13	156
Horsepower	22,440	1,212	21,228
Gas and gasoline—			
Number	4	1	3
Horsepower	100	20	80
Water wheels—			
Number	1		1
Horsepower	1		1
Electric motors—			
Number	210	3	207
Horsepower	6,981	125	6,856
Rented—			
Electric motors—			
Number	66		66
Horsepower	3,126		3,126

[1] Not included in the total or aggregate value.

ZINC SMELTING.

The vigorous growth of the zinc smelting industry noted at the census of 1900 has continued, and the production of spelter, including sheet zinc, at the census of 1905 reached a total of 186,990 tons, as compared with 131,546 tons for 1900, 58,860 tons for 1890, and 23,239 tons for 1880. This shows an increase of 35,621 tons for the decade 1880 to 1890; 72,686 tons for the decade 1890 to 1900; and 55,444 tons for the five-year period 1900 to 1905.

The general comparative statistics for the industry are given in Table 34 for 1890, 1900, and 1905, with the per cent of increase. The statistics for 1890 in the table are taken from the Eleventh Census of

TABLE 34.—*Zinc smelting—comparative summary, with per cent of increase: 1890 to 1905.*

	CENSUS.			PER CENT OF INCREASE.	
	1905	1900	1890 [1]	1900 to 1905	1890 to 1900
Number of establishments	31	31	21		47.6
Capital	$23,701,586	$14,141,810	$4,469,386	67.6	216.4
Salaried officials, clerks, etc., number	354	208	95	70.2	118.9
Salaries	$581,479	$440,200	$140,280	32.1	213.8
Wage-earners, average number	6,528	4,869	2,690	34.1	81.0
Total wages	$3,856,466	$2,355,921	$1,424,981	63.7	65.3
Men 16 years and over	6,506	4,843	(2)	34.3	
Wages	$3,851,120	$2,348,338	(2)	64.0	
Women 16 years and over	2	8	(2)	[3] 75.0	
Wages	$624	$3,369	(2)	[3] 81.5	
Children under 16 years	20	18	(2)	11.1	
Wages	$4,722	$4,214	(2)	12.1	
Miscellaneous expenses	$1,326,621	$399,472	$226,232	232.1	76.6
Cost of materials used	$17,028,418	$13,286,058	$4,807,710	28.2	176.3
Value of products	$24,791,299	$18,188,498	(4)	36.3	

[1] Report on Mineral Industries, Eleventh Census.
[2] Not reported separately.
[3] Decrease.
[4] Value of products not reported.

Although the number of establishments is the same for 1905 as for 1900, the increase in capital invested, wage-earners, and materials and products indicate the steady growth of the industry. In addition to the active establishments shown, there were 3 idle establishments reported at the census of 1905, located 2 in Iowa and 1 in Pennsylvania, which reported capital investment and power equipment as shown in Table 35.

TABLE 35.—*Zinc smelting—idle establishments: 1905.*

Number of establishments	3
Capital, total	$386,000
Land	$131,600
Buildings	$216,600
Machinery, tools, and implements	$35,300
Cash and sundries	$2,500
Power, owned:	
Number of establishments reporting	3
Total horsepower	1,095
Engines, steam—	
Number	5
Horsepower	1,070
Water wheels—	
Number	1
Horsepower	25

In 1900 there were 2 idle establishments, in addition to the 31 active establishments, with a capital of $59,500, located 1 in Kansas and 1 in Virginia.

On account of the different methods of treating the smelting industry prior to 1890 Census figures comparable with those of 1900 and 1905 are not available, but the production of spelter as compiled by the Geological Survey since 1873 is presented in Table 36.

TABLE 36.—*Production of spelter in the United States: 1873 to 1904.*[1]

YEAR.	Quantity (tons).	YEAR.	Quantity (tons).
1904	186,702	1891	80,873
1903	159,219	1890	63,683
1902	156,927	1889	58,860
1901	140,822	1888	55,903
1900	123,886	1887	50,340
1899	129,051	1886	42,641
1898	115,399	1885	40,688
1897	99,980	1884	38,544
1896	81,499	1883	36,872
1895	89,686	1882	33,765
1894	75,328	1880	23,239
1893	78,832	1875	15,833
1892			

The total production of spelter, including sheet zinc made at the smelters, as reported at the census of 1905, was 186,990 tons, or 288 tons more than for the calendar year 1904 as shown in Table 36, due to the fact that the periods covered are not identical. The returns for the United States Geological Survey are for the calendar year, while the reports for the Census Office cover the fiscal year of the establishment reporting most nearly conforming to the calendar year 1904, and in a number of reports the fiscal year includes part of 1905.

THE INDUSTRY, BY STATES.

The general statistics, by states, for the censuses of 1900 and 1905, so far as they can be given, are shown in Table 37.

TABLE 37.—ZINC SMELTING—COMPARATIVE SUMMARY, BY STATES: 1905 AND 1900.

STATE.	Census.	Number of establishments.	Capital.	Salaried officials, clerks, etc.: Number.	Salaried officials, clerks, etc.: Salaries.	Wage-earners and wages: Average number.	Wage-earners and wages: Wages.	Miscellaneous expenses.	Cost of materials used.	Value of products.
United States	1905	31	$23,701,586	354	$581.479	6,528	$3,856,466	$1,326,621	$17,028,418	$24,791,299
	1900	31	14,141,810	208	440,200	4,869	2,355,921	399,472	13,286,058	18,188,498
Illinois	1905	5	2,876,201	74	140,158	1,643	883,504	102,947	3,900,058	5,425,636
	1900	5	3,186,319	80	222,022	1,551	758,912	109,407	4,416,815	5,882,746
Indiana	1900	3	144,835	8	7,650	119	58,138	5,588	387,399	445,643
Kansas	1905	13	10,903,432	141	247,433	2,507	1,569,533	412,310	8,448,549	10,999,468
	1900	11	5,218,529	40	60,800	1,487	705,803	81,169	4,678,946	5,790,144
Missouri	1905	4	602,898	24	34,316	364	233,590	25,560	1,154,366	1,624,480
	1900	5	804,029	17	36,880	500	268,196	36,903	1,651,387	2,011,724
Pennsylvania [1]	1900	3	1,871,626	9	13,669	448	174,510	4,869	896,192	1,521,307
All other states	[2] 1905	9	9,319,055	115	159,572	2,014	1,169,839	785,804	3,525,445	6,741,715
	[3] 1900	4	2,916,472	54	99,179	764	390,362	161,536	1,255,319	2,536,934

[1] Included in "all other states" in 1905.
[2] Includes establishments distributed as follows: Colorado, 2; New Jersey, 1; Pennsylvania, 3; Virginia, 1; West Virginia, 1; Wisconsin, 1.
[3] Includes establishments distributed as follows: New Jersey, 2; Virginia, 1; Wisconsin, 1.

The production of the Illinois and Missouri zinc smelters shows a decrease at the census of 1905 over that of 1900, and no production was reported from Indiana, but the output of the Kansas zinc smelters has nearly doubled since 1900, and Pennsylvania's output has more than doubled, though the detailed statistics for the latter state can not be shown and are included in "all other states."

Table 38 presents the statistics for establishments located east and west of the Mississippi river, for the censuses of 1900 and 1905, with per cent of increase.

TABLE 38.—ZINC SMELTING—COMPARATIVE SUMMARY OF ESTABLISHMENTS, BY LOCATION, EAST AND WEST OF THE MISSISSIPPI RIVER: 1905 AND 1900.

	TOTAL.		EAST OF THE MISSISSIPPI.		WEST OF THE MISSISSIPPI.		PER CENT OF INCREASE.		
	1905	1900	1905	1900	1905	1900	Total.	East.	West.
Number of establishments	31	31	12	15	19	16	......	[1] 20.0	18.7
Capital	$23,701,586	$14,141,810	$9.917,256	$8,119,252	$13,784,330	$6,022,558	67.6	22.1	128.9
Salaried officials, clerks, etc., number	354	208	171	151	183	57	70.2	13.2	221.1
Salaries	$581,479	$440,200	$259,891	$342,520	$321,588	$97,680	32.1	[1] 24.1	229.2
Wage-earners, average number	6,528	4,869	3,169	2,882	3,359	1,987	34.1	10.0	69.0
Total wages	$3,856,466	$2,355,921	$1,632,496	$1,381,922	$2,223,970	$973,999	63.7	18.1	128.3
Miscellaneous expenses	$1,326,621	$399,472	$860,916	$281,400	$465,705	$118,072	232.1	205.9	294.4
Materials used, total cost	$17,028,418	$13,286,058	$6,723,118	$6,955,725	$10,305,300	$6,330,333	28.2	[1] 3.3	62.8
Ore—									
Tons	743,760	463,609	401,781	289,618	341,979	173,991	60.4	38.7	96.5
Cost	$13,663,667	$10,995,846	$5,114,069	$5,174,548	$8,549,598	$5,821,298	24.3	[1] 1.2	46.9
All other materials	$3,364,751	$2,290,212	$1,609,049	$1,781,177	$1,755,702	$509,035	46.9	[1] 9.7	244.9
Products, total value	$24,791,299	$18,188,498	$10,733,676	$10,386,630	$14,057,623	$7,801,868	36.3	3.3	80.2
Spelter and sheet zinc—									
Pounds	373,979,078	263,091,688	116,346,975	117,846,473	257,632,103	145,245,215	42.1	[1] 1.3	77.4
Value	$19,210,859	$14,843,416	$6,387,505	$7,041,548	$12,823,354	$7,801,868	29.4	[1] 9.3	64.4
All other products	$5,580,440	$3,345,082	$4,346,171	$3,345,082	$1,234,269	....	66.8	29.9	....

[1] Decrease.

In 1900, although the quantity of zinc made by the western establishments exceeded the zinc output of the eastern plants, the total value of the products of the eastern plants was largely in excess, the latter producing $3,143,370 of zinc oxide and sulphuric acid besides other products, in addition to spelter and sheet zinc products; that is, in 1900 the output of the western smelters was all in the form of spelter; while of the eastern establishments only 67.8 per cent of the total products was spelter and sheet zinc.

For 1905 the western establishments show a production of 257,632,103 pounds of zinc (spelter and sheet zinc), of a value of $12,823,354, an increase of 77.4 per cent in quantity and 64.4 per cent in value over 1900, and in addition zinc oxide, sulphuric acid, and other products of a value of $1,234,269; whereas the

eastern establishments show a slight decrease in zinc metal product for 1905 over 1900, with an increase in other products, the total products of the eastern smelters showing a small increase of 3.3 per cent, as compared with an increase of 80.2 per cent for the western establishments. For 1905 zinc metal constituted 59.5 per cent of the total products of the eastern smelters (67.8 per cent in 1900) and 91.2 per cent of the product of the western.

The capital invested in the entire industry shows a very heavy increase, and, as at the census of 1900, is in part due to improvements in appliances and in part to the development of industries collateral to zinc smelting, viz, the manufacture of zinc oxide, sulphuric acid, and the rolling of zinc. The production of rolled sheet zinc by zinc smelting establishments has increased from 9,389 tons at the census of 1890 to 17,723 tons at the census of 1900 and to 24,346 tons for 1905, an increase of 37.4 per cent for 1905 as compared with 1900. The production of zinc oxide by smelting establishments increased from 37,557 tons for 1900 to 58,743 tons for 1905, or 56.4 per cent; and sulphuric acid from 58,828 tons for 1900 to 77,305 tons for 1905, or 31.4 per cent.

In the report for the zinc smelting industry for the Twelfth Census a presentation was made of the statistics by two groups of states, one group including the works of the Mississippi valley states, which are dependent almost exclusively upon the ores mined in the Mississippi valley, and purchase their ores in the open market, and the other group including the works of the states which control nearly the whole of their own ore supply. The first group then included the works of Illinois, Indiana, Kansas, Missouri, and Wisconsin, and the latter, the works of Pennsylvania, New Jersey, and Virginia, all eastern states.

Table 39 presents corresponding statistics for 1905 in comparison with those of 1900, and gives the per cent of increase.

TABLE 39.—ZINC SMELTING—COMPARATIVE SUMMARY OF ESTABLISHMENTS ARRANGED ACCORDING TO LOCATION: 1905 AND 1900.

	TOTAL.		EASTERN STATES.[1]		WESTERN STATES.[2]		PER CENT OF INCREASE.		
	1905	1900	1905	1900	1905	1900	Total.	Eastern.	Western.
Number of establishments	31	31	6	6	25	25	......	......	......
Capital	$23,701,586	$14,141,810	$6,498,055	$4,193,098	$17,203,531	$9,948,712	67.6	54.9	72.9
Salaried officials, clerks, etc., number	354	208	75	48	279	160	70.2	56.2	74.4
Salaries	$581,479	$440,200	$95,911	$88,668	$485,568	$351,532	32.1	8.2	38.1
Wage-earners, average number	6,528	4,869	1,348	1,080	5,180	3,789	34.1	24.8	36.7
Total wages	$3,856,466	$2,355,921	$658,634	$506,258	$3,197,832	$1,849,663	63.7	30.1	72.9
Miscellaneous expenses	$1,326,621	$399,472	$742,969	$157,325	$583,652	$242,147	232.1	372.3	141.0
Materials used, total cost	$17,028,418	$13,286,058	$2,534,060	$1,799,315	$14,494,358	$11,486,743	28.2	40.8	26.2
Ore—									
Tons	743,760	463,609	285,796	163,459	457,964	300,150	60.4	74.8	52.6
Cost	$13,663,667	$10,995,846	$1,662,474	$889,819	$12,001,193	$10,106,027	24.3	86.8	18.8
All other materials	$3,364,751	$2,290,212	$871,586	$909,496	$2,493,165	$1,380,716	46.9	[3]4.2	80.6
Products, total value	$24,791,299	$18,188,498	$4,815,340	$3,552,330	$19,975,959	$14,636,168	36.3	35.6	36.5
Spelter and sheet zinc—									
Pounds	373,979,078	263,091,688	22,927,636	17,610,736	351,051,442	245,480,952	42.1	30.2	43.0
Value	$19,210,859	$14,843,416	$1,406,339	$1,196,145	$17,804,520	$13,647,271	29.4	17.6	30.5
All other products	$5,580,440	$3,345,082	$3,409,001	$2,356,185	$2,171,439	$988,897	66.8	44.7	119.6

[1] Includes states as follows: 1905—New Jersey, Pennsylvania, Virginia, West Virginia. 1900—New Jersey, Pennsylvania, Virginia.
[2] Includes states as follows: 1905—Colorado, Illinois, Kansas, Missouri, Wisconsin. 1900—Illinois, Indiana, Kansas, Missouri, Wisconsin.
[3] Decrease.

The state of Colorado appears as a producer for 1905 and has been included in the first group, though the ores handled by the Colorado smelters are not Mississippi valley ores. The table therefore presents the statistics grouped to show the western establishments, which with one exception purchased their ores, and the eastern establishments, which control nearly the whole of their own supply.

There were 4 establishments which treated exclusively ores produced from their own mines, valued in all at $1,539,106 and located 1 in Missouri, 1 in New Jersey, and 2 in Pennsylvania. All other establishments operated on purchased ores.

The establishments purchasing their ores report the price paid for ore in the open market, while the establishments smelting ores produced by their own mines necessarily have to report an estimated cost for the ore at the smelter. The ores handled by the Colorado smelters are low grade zinc ores carrying values in lead and the precious metals, and are not in the same class with the rich zinc ores of the Mississippi valley. The average cost price paid by the Colorado smelters for ores approximates nearer to that of the eastern group than to that of the Mississippi valley smelters. The average cost per ton of the ores purchased by the Mississippi valley smelters for 1905 was $28.35 per ton as compared with an average cost of $33.67 for 1900, whereas the average cost of the ores used by the eastern group for 1905 was $5.82 per ton as against $5.44 per ton for 1900. At the census of 1900, the price of zinc ore in the Mississippi valley district was subject to wide fluctuations, zinc ore of standard quality in the bin at the mines reaching $55 per ton, and the average was abnormally high.

PRODUCTS.

Table 40 shows in detail the specific products of the zinc smelters for the United States, for 1900 and 1905.

TABLE 40.—*Zinc smelting—products, by kind, quantity, and value: 1905 and 1900.*

KIND.	1905	1900	Per cent of increase.
Total value	$24,791,299	$18,188,498	36.3
Spelter—			
Pounds	325,287,010	227,646,314	42.9
Value	$16,379,383	$12,348,036	32.6
Sheet zinc—			
Pounds	48,692,068	35,445,374	37.4
Value	$2,831,476	$2,495,380	13.5
Zinc oxide—			
Pounds	117,485,861	75,114,904	56.4
Value	$4,330,394	$2,718,700	59.3
Sulphuric acid—			
Pounds	154,609,036	117,655,214	31.4
Value	$576,060	$424,670	35.6
All other products	$673,986	$201,712	234.1

Between 1900 and 1905 the total production of zinc metal—spelter and sheet zinc—increased 110,887,390 pounds, or 42.1 per cent.

Kansas, which stood second at the census of 1890, was easily first both for 1900 and 1905. Its spelter product for 1900 was 109,031,632 pounds, or 41.4 per cent of the total spelter and sheet zinc product, and for 1905 its spelter and sheet zinc product was 221,638,884 pounds, or 59.3 per cent of the total. Illinois was second at both censuses, with 91,517,175 pounds of spelter and sheet zinc, or 34.8 per cent of the total product for 1900, and 93,419,339 pounds, or 25 per cent, for 1905; Missouri was third in both cases, with 36,213,583 pounds of spelter, or 13.8 per cent, for 1900, and 24,249,219 pounds of spelter, or 6.5 per cent, for 1905; and Pennsylvania fourth, with 3.6 per cent in 1900 and 4.1 per cent for 1905. Colorado and West Virginia appear as producers for the first time for 1905.

The use of natural gas as fuel was confined, at the census of 1905, to smelters in Kansas, and 9 plants reported natural gas used as fuel; 6 using gas from wells operated by the same owner, and 4 using purchased gas.

The following statement shows the fuel expense of the Kansas establishments:

CLASS OF FUEL USED.	Cost.
Total	$507,930
Natural gas, total	244,206
From wells operated by same owner	163,487
Purchased	80,719
Other fuel	263,724

In only 2 cases was natural gas alone used, 7 of the establishments using natural gas also using other fuel. Other fuel was used entirely by 2 smelters in the state.

The values reported for the products are the net values. The statistics with respect to amounts paid for freight and commissions and selling expenses are too incomplete to permit of any general deductions as to gross value of products. Of the 31 establishments, 8 reported freight on product to the amount of $197,315, and commissions and selling expenses to the amount of $38,452 on 133,597,263 pounds of spelter products of a net value of $6,724,034, or a gross value of $6,959,801. But 3 of these 8 establishments reported deductions on value of product for freight only, 1 a deduction for commissions and selling expenses only, and 4 deductions on account of freight and commissions and selling expenses. The 4 establishments reporting deductions for both freight and commissions and selling expenses were located 3 in Kansas and 1 in Missouri, and the total quantity of spelter product was 62,338,520 pounds, of a value per New York and St. Louis quotations of $3,072,469 and a net value of $2,967,619. The deductions were $81,040 for freight and $23,810 for commissions and selling expenses. The average gross value per pound, or value per New York and St. Louis quotations, was therefore 4.93 cents in the case of these 4 establishments; deductions for freight, 0.13 cent; for commissions and selling expenses, 0.04 cent, and net value, 4.76 cents.

Table 41 gives the detailed statistics for the industry at the census of 1905.

TABLE 41.—ZINC SMELTING—DETAILED SUMMARY, BY STATES: 1905.

	United States.	Illinois.	Kansas.	Missouri.	All other states.[1]
Number of establishments	31	5	13	4	9
Capital, total	$23,701,586	$2,876,201	$10,903,432	$602,898	$9,319,055
Land	$2,248,905	$263,050	$1,077,481	$24,000	$884,374
Buildings	$8,545,416	$554,000	$5,444,616	$113,700	$2,433,100
Machinery, tools, and implements	$4,688,300	$894,980	$1,670,650	$119,487	$2,003,183
Cash and sundries	$8,218,965	$1,164,171	$2,710,685	$345,711	$3,998,398
Proprietors and firm members	2	....	....	2	....
Salaried officials, clerks, etc.:					
Total number	354	74	141	24	115
Total salaries	$581,479	$140,158	$247,433	$34,316	$159,572
Officers of corporations—					
Number	50	9	18	2	21
Salaries	$157,807	$51,137	$65,701	$10,400	$30,569
General superintendents, managers, clerks, etc.—					
Total number	304	65	123	22	94
Total salaries	$423,672	$89,021	$181,732	$23,916	$129,003
Men—					
Number	287	64	109	21	93
Salaries	$413,836	$88,221	$173,932	$23,016	$128,667
Women—					
Number	17	1	14	1	1
Salaries	$9,836	$800	$7,800	$900	$336

[1] Includes establishments distributed as follows: Colorado, 2; New Jersey, 1; Pennsylvania, 3; Virginia, 1; West Virginia, 1; Wisconsin, 1.

TABLE 41.—ZINC SMELTING—DETAILED SUMMARY, BY STATES: 1905—Continued.

	United States.	Illinois.	Kansas.	Missouri.	All other states.
Wage-earners, including pieceworkers, and total wages:					
Greatest number employed at any one time during the year	7,637	1,697	3,031	431	2,478
Least number employed at any one time during the year	5,272	1,585	1,883	298	1,506
Average number	6,528	1,643	2,507	364	2,014
Total wages	$3,856,466	$883,504	$1,569,533	$233,590	$1,169,839
Men 16 years and over—					
Average number	6,506	1,628	2,507	364	2,007
Wages	$3,851,120	$879,627	$1,569,533	$233,590	$1,168,370
Women 16 years and over—					
Average number	2				2
Wages	$624				$624
Children under 16 years—					
Average number	20	15			5
Wages	$4,722	$3,877			$845
Average number of wage-earners, including pieceworkers, employed during each month:					
Men 16 years and over—					
January	6,096	1,600	2,200	263	2,033
February	6,107	1,596	2,146	273	2,092
March	6,849	1,612	2,596	400	2,241
April	6,827	1,629	2,564	396	2,238
May	6,858	1,648	2,569	407	2,234
June	6,674	1,669	2,530	395	2,080
July	6,534	1,651	2,613	399	1,871
August	6,434	1,630	2,568	405	1,831
September	6,410	1,640	2,565	383	1,822
October	6,345	1,591	2,610	309	1,835
November	6,413	1,634	2,543	363	1,873
December	6,525	1,636	2,580	375	1,934
Women 16 years and over—					
January	2				2
February	2				2
March	2				2
April	2				2
May	2				2
June	2				2
July	2				2
August	2				2
September	2				2
October	2				2
November	2				2
December	2				2
Children under 16 years—					
January	19	15			4
February	19	15			4
March	19	15			4
April	19	15			4
May	19	15			4
June	19	15			4
July	23	15			8
August	23	15			8
September	23	15			8
October	19	15			4
November	19	15			4
December	19	15			4
Miscellaneous expenses, total	$1,326,621	$102,947	$412,310	$25,560	$785,804
Rent of works	$3,600			$3,600	
Taxes	$65,172	$15,347	$28,974	$2,601	$18,250
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$1,251,359	$87,600	$378,793	$17,412	$767,554
Contract work	$6,490		$4,543	$1,947	
Materials used, aggregate cost	$17,028,418	$3,900,058	$8,448,549	$1,154,366	$3,525,445
Ore—					
Tons	743,760	98,985	257,022	34,136	353,617
Cost	$13,663,667	$3,251,595	$7,152,761	$959,485	$2,299,826
Flux and other materials operated upon	$535,001	$46,306	$337,142		$151,553
Fuel, total cost	$1,666,281	$477,223	$507,930	$144,886	$536,242
Natural gas	$244,206		$244,206		
Other fuel	$1,422,075	$477,223	$263,724	$144,886	$536,242
Mill supplies	$137,826	$8,089	$28,456	$24,359	$76,922
All other materials	$654,389	$21,412	$249,178	$22,897	$360,902
Freight	$371,254	$95,433	$173,082	$2,739	$100,000
Products, total value	$24,791,299	$5,425,636	$10,999,468	$1,624,480	$6,741,715
Zinc spelter and sheet zinc—					
Pounds	373,979,078	93,419,339	221,638,884	24,249,219	34,671,636
Value	$19,210,859	$4,981,166	$10,911,468	$1,336,480	$1,981,745
All other products	$5,580,440	$444,470	$88,000	$288,000	$4,759,970
Power:					
Number of establishments reporting	31	5	13	4	9
Total horsepower	23,452	5,574	5,739	430	11,709
Owned—					
Engines—					
Steam—					
Number	154	41	71	11	31
Horsepower	17,556	5,187	5,701	430	6,238
Gas and gasoline—					
Number	5		4		1
Horsepower	48		38		10
Electric motors—					
Number	219	34			185
Horsepower	5,048	387			4,661
Other kind, horsepower	800				800
Furnished to other establishments, horsepower	25				25

AGRICULTURAL IMPLEMENTS

AGRICULTURAL IMPLEMENTS.

The statistics of the manufacture of agricultural implements extend over half a century. They include the number and value of implements used for tilling the soil, sowing or planting the seed, harvesting, and preparing the crop for the market.

The importance of this industry is shown by the value of farm implements and machinery in use on the farms of the United States which in 1904 reached the sum of $844,989,863,[1] a gain of nearly $100,000,000 since 1900. The invention and perfection of machinery for use in connection with agriculture have revolutionized farming in the United States, and thus have exercised a far-reaching influence upon the economic conditions of the nation. Moreover, a large proportion of the labor-saving devices in use in the year 1905 upon farms in all parts of the globe were of American design and manufacture. But in spite of the wide extent of its market, the area of significant product within the United States is relatively small.

At the outset the industry was widely distributed in small shops over the country. The implements used were of simple construction, and their manufacture required little capital. With the progress in agriculture the demand grew for labor-saving devices. The increased cost of producing such machinery required increased capital, and to make the industry pay under present conditions, extensive and particularly expensive exploitation has been necessary. Indeed, the requirement for a large and increasing proportion of capital to product is now a marked characteristic of the industry.

The manufacture of agricultural implements is so closely allied to that of foundry and machine shop products that some establishments classified as "agricultural implements" at one census so change the character of their products as to come entirely or principally under "foundry and machine shop products" at a succeeding census, and thus drop out of the class in which they had been previously included. Such changes should be considered in comparing the statistics for the different censuses.

Table 1 presents the leading facts of the industry for each census from 1850 to 1905.

[1] Bureau of the Census, Report on Wealth, Debt, and Taxation, page 37.

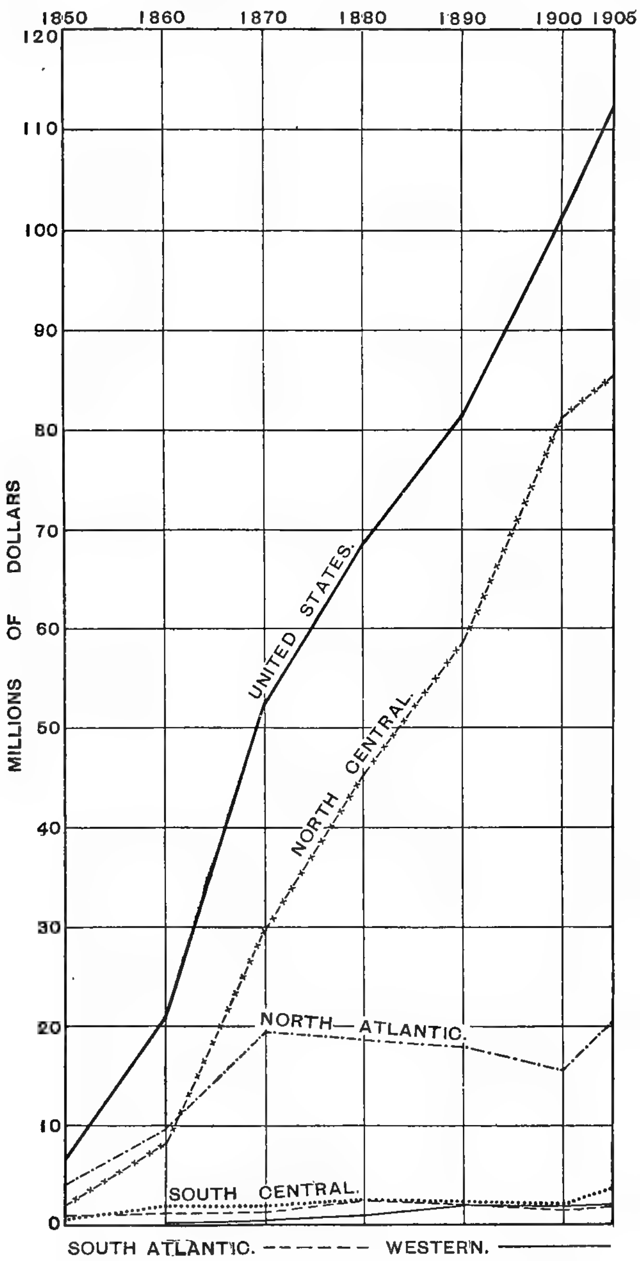
TABLE 1.—COMPARATIVE SUMMARY, WITH PER CENT OF INCREASE: 1850 TO 1905.

	CENSUS.							PER CENT OF INCREASE.					
	1905[1]	1900	1890	1880	1870	1860	1850	1900 to 1905	1890 to 1900	1880 to 1890	1870 to 1880	1860 to 1870	1850 to 1860
Number of establishments	648	715	910	1,943	2,076	2,116	1,333	[2]9.4	[2]21.4	[2]53.2	[2]6.4	[2]1.9	58.7
Capital	$196,740,700	$157,707,951	$145,313,997	$62,109,668	$34,834,600	$13,866,389	$3,564,202	24.8	8.5	134.0	78.3	151.2	289.0
Salaried officials, clerks, etc., number	7,199	10,046	[3]3,717	(4)	(4)	(4)	(4)	[2]28.3	170.3	......	......	......	......
Salaries	$7,572,646	$8,363,210	[3]$3,704,667	(4)	(4)	(4)	(4)	[2]9.5	125.7	......	......	......	......
Wage-earners, average number	47,394	46,582	38,827	39,580	25,249	17,093	7,220	1.7	20.0	[2]1.9	56.8	47.7	136.7
Total wages	$25,002,650	$22,450,880	$18,107,094	$15,359,610	$12,151,504	$5,925,177	$2,167,868	11.4	24.0	17.9	26.4	105.1	173.3
Men 16 years and over	46,631	46,174	38,327	38,313	24,634	17,086	7,211	1.0	20.5	(5)	55.5	44.2	136.9
Wages	$24,777,846	$22,358,158	$17,998,650	(4)	(4)	(4)	(4)	10.8	24.2	......	......	......	......
Women 16 years and over	579	214	288	73	12	7	9	170.6	[2]25.7	294.5	508.3	71.4	[2]22.2
Wages	$191,308	$66,042	$75,553	(4)	(4)	(4)	(4)	189.7	[2]12.6	......	......	......	......
Children under 16 years	184	194	212	1,194	603	(4)	(4)	[2]5.2	[2]8.5	[2]82.2	98.0	......	......
Wages	$33,496	$26,680	$32,891	(4)	(4)	(4)	(4)	25.5	[2]18.9	......	......	......	......
Miscellaneous expenses	$15,178,098	$11,394,656	$11,129,548	(6)	(6)	(6)	(6)	33.2	2.4	......	......	......	......
Cost of materials used	$48,281,406	$43,944,628	$31,603,265	$31,531,170	$21,473,925	$6,993,162	$2,445,765	9.9	39.1	0.2	46.8	207.1	185.9
Value of products	$112,007,344	$101,207,428	$81,271,651	$68,640,486	$52,066,875	$20,831,904	$6,842,611	10.7	24.5	18.4	31.8	149.9	204.4

[1] Exclusive of the statistics of 93 establishments engaged primarily in the manufacture of other products. These establishments made agricultural implements to the value of $1,349,679.
[2] Decrease.
[3] Includes proprietors and firm members, with their salaries; number only reported in 1905 and 1900, but not included in this table.
[4] Not reported separately.
[5] Less than one-tenth of 1 per cent.
[6] Not reported.

The number of establishments has steadily decreased since 1860 until in 1905 there were less than half the number reported in 1850. To some extent this reduction is accounted for by the changes in classification, but a more important reason is undoubtedly the absorption of small establishments by large ones.

DIAGRAM 1.—*Comparative growth of the value of products, by geographic divisions: 1850 to 1905.*



With increased transportation facilities which bring the products of the great factories within easy reach of the farmer, many small shops which were formerly equal to supplying all local demands, have been either driven out of business or absorbed by larger establishments.

Coincident with the decrease in establishments there has been a steady increase in capital. Between 1850 and 1905 capital increased over fiftyfold. This increase is explained in part by the different methods of reporting capital employed at various censuses. Live capital—cash on hand, bills receivable, material and stock on hand, etc.—was first reported at the census of 1890. In all discussion of capital this fact should not be overlooked.

The decrease in the number of establishments and the increase in the capital invested, number of persons employed, and value of products indicate a concentration of the industry.

The centralizing tendency is further illustrated by the fact that the average capital invested and the average value of products per establishment increased from $2,674 and $5,133, respectively, at the census of 1850, to $303,612 and $172,850 at the census of 1905.

It is probable that the tendency shown toward increasing cost of materials is in part the result of change in the character of the principal material, rather than an increase in quantity. Wood was superseded by iron, and that in turn by steel. Furthermore, prices of the same material fluctuated from year to year, so that only the most general deductions can be made from the returns for cost of materials.

Value of products showed no change commensurate with those recorded in number of establishments. The value of products of the industry in 1905 was approximately sixteen times that of 1850. In the last thirty-five years the value of products has increased moderately but steadily. From 1900 to 1905, computed on the decade basis, the percentage of increase was slightly less than during the previous decade. It must be remembered, however, that the value of products in many industries has become so large that a small percentage often represents a great absolute increase.

The current expenditure per dollar of product—that is, salaries, wages, miscellaneous expenses, and cost of materials—has increased from 79 cents in 1890 to 85 cents in 1900 and 86 cents in 1905. Prior to 1890 the only items of current expenditures reported separately were wages and material. The amount thus expended per dollar of product was singularly uniform throughout the thirty years—67 cents in 1850, 62 cents in 1860, 65 cents in 1870, and 68 cents in 1880.

The following tabular statement shows the average value of products per establishment from 1850 to 1905:

CENSUS.	AVERAGE VALUE OF PRODUCTS PER ESTABLISHMENT.	
	Amount.	Per cent of increase.
1905	$172,850.84	22.1
1900	141,548.85	58.5
1890	89,309.51	152.8
1880	35,327.06	40.9
1870	25,080.38	154.8
1860	9,844.95	91.8
1850	5,133.24	....

The industry by geographic divisions.—The distribution of the returns by geographic divisions of states brings out in a striking way the localization of the industry; this is shown in Table 2.

TABLE 2.—PER CENT DISTRIBUTION OF ESTABLISHMENTS, CAPITAL, AND VALUE OF PRODUCTS, WITH PER CENT OF INCREASE, BY GEOGRAPHIC DIVISIONS: 1905 AND 1900.

DIVISION.	ESTABLISHMENTS.			CAPITAL.			VALUE OF PRODUCTS.		
	Per cent of total.		Per cent of increase.	Per cent of total.		Per cent of increase.	Per cent of total.		Per cent of increase.
	1905	1900		1905	1900		1905	1900	
United States	100.0	100.0	[1] 9.4	100.0	100.0	24.8	100.0	100.0	10.7
North Atlantic	26.4	29.1	[1] 17.8	15.9	16.9	17.3	17.9	15.3	30.0
South Atlantic	7.2	5.7	14.6	0.7	0.7	20.8	1.5	1.2	33.3
North Central	57.6	57.6	[1] 9.5	80.6	79.7	26.2	76.1	80.1	5.2
South Central	4.3	4.1	[1] 3.4	1.5	1.4	31.7	2.9	1.9	69.3
Western	4.5	3.5	16.0	1.3	1.3	24.3	1.6	1.5	15.9

[1] Decrease.

The predominance of the North Central division in both 1900 and 1905 is very marked. The only division which in any degree competes with it is the North Atlantic. The latter, although it did not contribute one-fourth as much to the total value of product, increased from 1900 to 1905 at a rate about six times that of the North Central division. The North Atlantic and the South Central divisions gained slightly in their proportion of products, at the expense of the leading group.

The industry, by states.—Centralization is further emphasized when the contribution of each state to the total is seen. Table 3 is a comparative summary, by states and geographic divisions, for 1900 and 1905.

TABLE 3.—COMPARATIVE SUMMARY, BY STATES AND GEOGRAPHIC DIVISIONS: 1905 AND 1900.

STATE.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
				Number.	Salaries.	Average number.	Wages.			
United States	1905	648	$196,740,700	7,199	$7,572,646	47,394	$25,002,650	$15,178,098	$48,281,406	$112,007,344
	1900	715	157,707,951	10,046	8,363,210	46,582	22,450,880	11,394,656	43,944,628	101,207,428
North Atlantic division	1905	171	31,327,403	1,280	1,175,095	9,921	4,944,159	2,094,553	8,511,900	20,087,471
	1900	208	26,703,466	973	967,287	8,202	3,969,712	1,156,856	6,749,331	15,454,912
Maine	1905	13	393,859	19	12,700	153	77,471	20,140	75,565	205,650
	1900	17	584,247	27	17,195	218	100,033	28,430	98,197	290,261
New Hampshire	1905	8	62,100	3	2,200	45	24,767	4,449	13,568	61,860
	1900	12	112,003	4	2,300	45	16,626	3,485	22,364	79,891
Vermont	1905	10	490,725	23	31,084	247	113,524	41,559	182,403	441,671
	1900	17	484,277	24	18,267	211	85,846	15,909	163,515	369,537
Massachusetts	1905	9	731,710	27	35,804	418	212,586	63,554	252,036	654,051
	1900	9	706,472	35	45,358	312	159,700	44,577	216,313	534,789
Connecticut	1905	3	320,374	17	17,148	181	81,698	16,253	117,420	269,743
	1900	5	348,221	19	13,330	154	62,111	9,961	76,132	194,746
New York	1905	75	23,436,429	934	809,322	6,279	3,240,885	1,329,244	5,678,339	13,045,891
	1900	87	20,115,962	659	675,999	5,551	2,797,269	833,948	4,824,871	10,537,254
New Jersey	1905	10	432,195	37	40,005	204	89,787	53,082	117,596	391,926
	1900	11	249,957	8	11,289	147	60,083	23,827	115,697	249,963
Pennsylvania	1905	43	5,460,011	220	226,832	2,394	1,103,441	566,272	2,074,973	5,016,679
	1900	50	4,102,327	197	183,549	1,564	688,044	196,719	1,232,242	3,198,471
South Atlantic division	1905	47	1,272,255	64	73,594	1,024	324,658	105,183	852,255	1,619,366
	1900	41	1,053,020	59	56,592	751	234,197	64,242	623,000	1,214,866
Virginia	1905	11	329,990	21	20,220	314	115,727	20,640	182,433	404,281
	1900	13	472,863	29	21,738	278	107,980	26,183	128,434	343,291
North Carolina	1905	13	116,735	8	9,250	107	30,883	5,108	50,950	126,865
	1900	9	77,537	7	3,970	91	20,169	1,971	41,047	99,128
South Carolina	1905	4	13,351	....	....	12	4,065	6,794	12,635	34,932
	1900	5	14,575	....	....	10	2,606	931	5,394	14,090
Georgia	1905	16	792,004	35	44,124	584	170,723	71,728	601,894	1,039,671
	1900	10	454,988	23	30,884	360	99,951	33,864	437,799	737,652
Not distributed by states	[1] 1905	3	20,175	....	....	7	3,260	913	4,343	13,617
	[2] 1900	4	33,057	....	....	12	3,491	1,293	10,326	20,705

[1] Includes establishments distributed as follows: Maryland, 2; West Virginia, 1.
[2] Includes establishments distributed as follows: Delaware, 1; Maryland, 2; West Virginia, 1.

Table 3.—COMPARATIVE SUMMARY, BY STATES AND GEOGRAPHIC DIVISIONS: 1905 AND 1900—Continued.

STATE.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
				Number.	Salaries.	Average number.	Wages.			
North Central division	1905	373	$158,310,927	5,579	$6,007,792	34,167	$18,617,027	$12,384,957	$36,561,534	$85,277,440
	1900	412	125,638,588	8,785	7,086,506	35,913	17,467,911	9,865,933	35,209,845	81,098,474
Ohio	1905	71	24,301,986	918	1,001,714	5,659	2,909,540	1,650,747	5,692,218	12,891,197
	1900	78	23,628,442	1,588	1,368,775	6,852	3,271,163	1,483,605	6,059,515	13,975,268
Indiana	1905	41	14,523,167	389	466,156	3,543	1,840,609	1,594,046	2,975,468	8,060,575
	1900	45	8,324,564	518	489,649	3,419	1,593,881	596,463	2,619,621	6,415,081
Illinois	1905	82	71,383,289	1,929	2,152,293	15,359	8,851,404	3,960,647	17,750,852	38,412,452
	1900	94	62,202,330	4,444	3,419,742	18,231	9,064,954	5,346,224	18,859,517	42,033,796
Michigan	1905	42	14,342,106	713	678,309	3,164	1,685,677	1,902,405	3,497,210	8,719,719
	1900	59	8,932,344	620	548,763	1,944	952,626	1,329,530	2,482,235	6,339,508
Wisconsin	1905	52	20,837,995	1,017	1,050,112	3,569	1,885,775	2,278,736	3,519,856	10,076,760
	1900	51	15,291,554	1,180	836,316	3,289	1,625,765	699,865	3,290,690	7,886,363
Minnesota	1905	21	7,793,316	249	319,375	1,176	637,232	541,739	1,089,641	2,885,055
	1900	18	3,730,055	182	189,832	928	423,054	241,388	718,604	1,763,780
Iowa	1905	30	3,319,102	231	204,277	1,027	469,690	337,149	1,356,712	2,692,212
	1900	24	1,878,090	154	123,472	644	243,489	96,540	669,989	1,508,667
Missouri	1905	21	1,299,575	89	93,161	525	261,116	57,362	452,056	1,068,008
	1900	26	1,412,165	81	101,977	493	242,307	65,325	406,977	953,965
Nebraska	1905	3	134,600	11	6,000	25	15,025	6,574	13,686	46,000
	1900	9	184,081	11	6,705	87	41,128	4,646	82,856	176,446
Kansas	1905	7	629,439	32	35,705	105	52,181	52,124	204,522	395,262
	1900	4	19,750	6	1,075	11	2,460	856	10,819	18,275
Not distributed by states	[1] 1905	3	46,352	1	690	15	8,778	3,428	9,313	30,200
	[2] 1900	4	35,213	1	200	15	7,074	1,491	9,022	27,325
South Central division	1905	28	2,996,365	176	201,585	1,724	711,643	427,575	1,547,395	3,289,546
	1900	29	2,274,794	140	169,085	1,102	428,630	184,932	752,712	1,942,840
Kentucky	1905	[illegible]	1,898,666	129	135,092	970	438,101	316,892	1,091,345	2,190,917
	1900	9	1,735,595	95	124,720	680	300,106	148,009	466,193	1,320,714
Tennessee	1905	12	756,812	34	50,593	613	216,306	65,203	314,279	768,895
	1900	11	417,689	38	35,065	373	113,425	12,170	201,712	463,406
Mississippi	1905	3	38,650	....	....	22	8,310	1,203	13,630	38,000
	[3] 1900	4	63,875	2	1,350	21	4,680	825	18,235	41,350
Texas	1905	4	147,271	8	9,400	47	23,943	36,402	74,233	187,134
	1900	5	57,635	5	7,950	28	10,419	23,928	66,572	117,370
Not distributed by states	[4] 1905	3	154,966	5	6,500	72	24,983	7,875	53,908	104,600
Western division	1905	29	2,533,750	100	114,580	558	405,163	165,830	808,322	1,733,521
	1900	25	2,038,083	89	83,740	614	350,430	122,693	609,740	1,496,336
California	1905	25	2,240,143	87	99,440	479	348,531	122,986	723,902	1,483,746
	1900	20	1,852,157	81	74,900	562	322,272	106,011	538,568	1,357,849
Not distributed by states	[5] 1905	4	293,607	13	15,140	79	56,632	42,844	84,420	249,775
	[6] 1900	5	185,926	8	8,840	52	28,158	16,682	71,172	138,487

[1] Includes establishments distributed as follows: North Dakota, 1; South Dakota, 2.
[2] Includes establishments distributed as follows: North Dakota, 1; South Dakota, 3.
[3] Includes 1 establishment in Alabama.
[4] Includes establishments distributed as follows: Alabama, 2; Arkansas, 1.
[5] Includes establishments distributed as follows: Colorado, 1; Utah, 1; Washington, 1; Oregon, 1.
[6] Includes establishments distributed as follows: Colorado, 1; Utah, 2; Washington, 2.

Of the 37 states engaged in the manufacture of agricultural implements in 1905, 23 have reported manufactures at each of the seven censuses since 1850, and 4 others—California, Kansas, Minnesota, and Texas—since 1860. In the 10 remaining states the industry has maintained an irregular existence.

In 1880 only 12 states reported products valued at over $1,000,000 each. All of these except Massachusetts and Missouri have continued in the same class, and 4—Indiana, Michigan, Wisconsin, and Pennsylvania—within twenty-five years have raised their contribution beyond the $5,000,000 mark. New York has been prominent at every census since 1850, but after 1860 it ceased to be preeminent. In 1905, however, New York reported a gain of $2,508,637 coincident with Illinois' loss of $3,621,344.

In 1905, 24 states having products valued at more than $100,000, contributed 99.6 per cent of the total value of products; 6, having products valued at between $1,000,000 and $5,000,000, 10.1 per cent; and 7, whose products passed the $5,000,000 mark, 85.9 per cent. Of the last 7, Illinois, New York, and Ohio contributed 57.5 per cent, and Illinois alone 34.3 to the total output.

From Map 1 it will be observed that with the exception of California and Georgia the states reporting in 1905 a product valued at less than $5,000,000 but more than $1,000,000 border on the states reporting highest production, bounding these on the south and west. Georgia has passed the $1,000,000 mark since

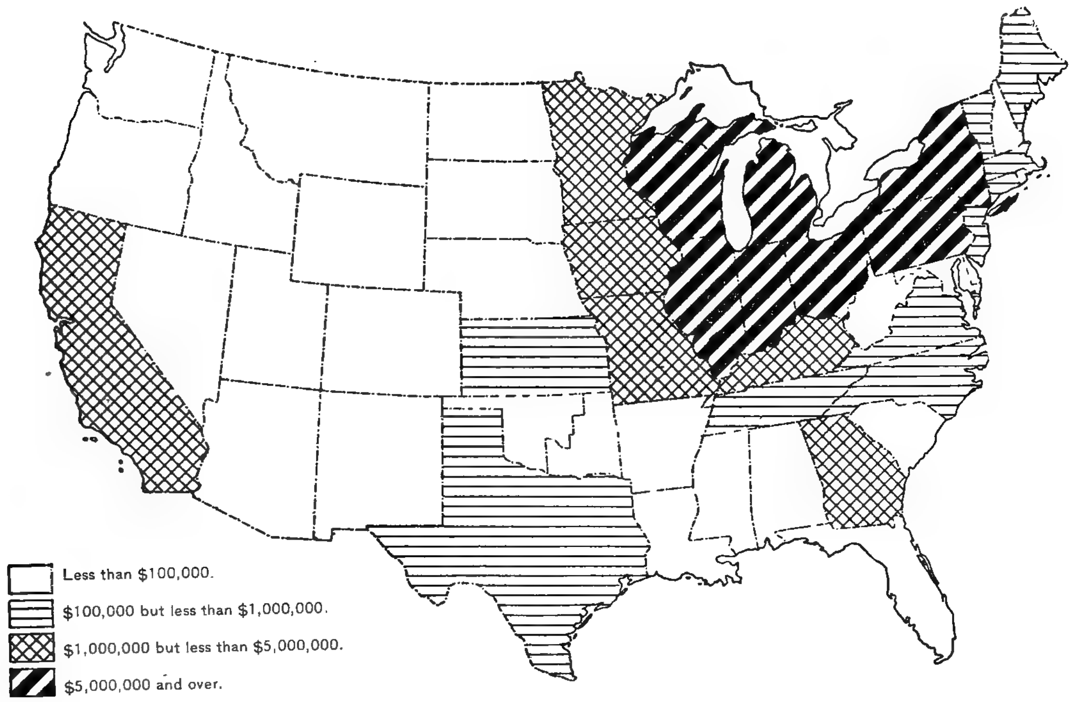
1900, having become a center for the South as California became for the West.

In addition to a decrease in the value of products in two of the leading states—Ohio and Illinois—there has been a decrease since 1900 in Maine, New Hampshire, and Nebraska. These last states, however, report a comparatively insignificant output.

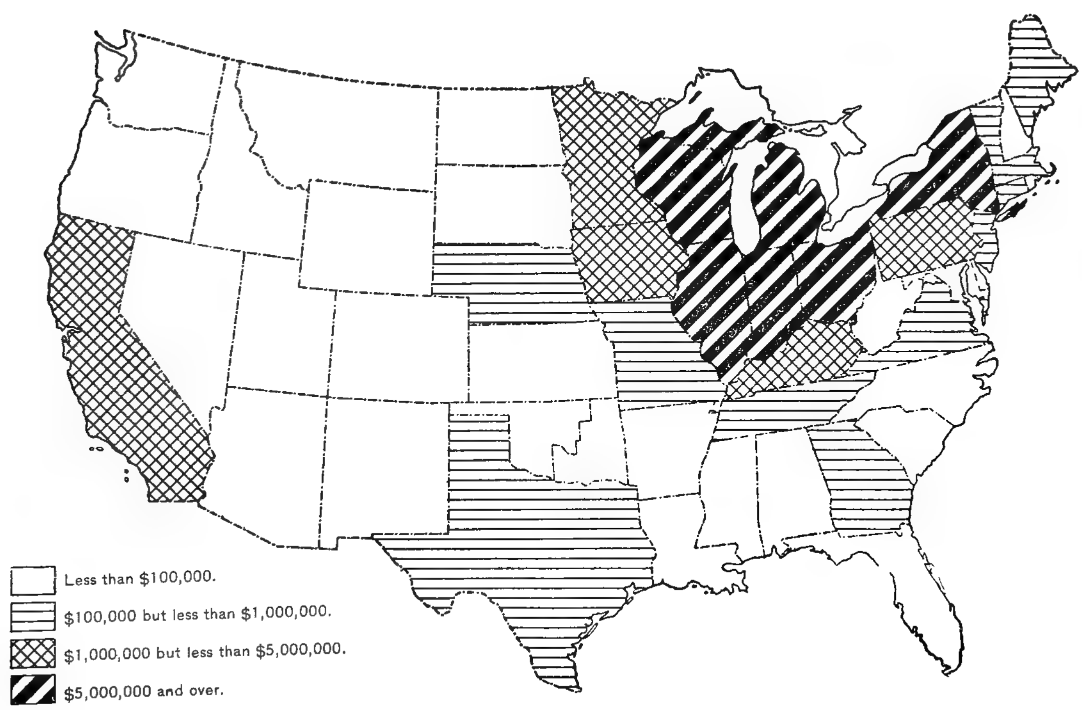
Rank of the three states leading in value of products in 1905: 1850 to 1905.

STATE.	1905	1900	1890	1880	1870	1860	1850
Illinois	1	1	1	2	3	3	4
New York	2	3	3	3	2	1	1
Ohio	3	2	2	1	1	2	5

MAP 1.—STATES HAVING PRODUCTS VALUED AT $100,000 AND OVER: 1905.



MAP 2.—STATES HAVING PRODUCTS VALUED AT $100,000 AND OVER: 1900.



The three states which led in 1860—New York, Ohio, and Illinois—were still the largest producers in 1905. They have each in turn held the lead, but Illinois outstripped Ohio in 1890, and made such rapid strides that it now far outdistances all others in value of products. The central location of Illinois and its proximity to the rich prairie farms of the central West is probably the primary cause of its preeminence.

It is unlikely that the decrease reported in 1905 in Illinois is more than temporary, since the decrease of $3,621,344 in value of products between 1900 and 1905 is due primarily to the fact that many of the largest plants had an unused production, or "carryover," at the close of the season of 1903 almost twice as large as that of any other year in their history. This resulted in a great decrease in production in 1904, the year covered by the census figures.

New centers of manufacture have appeared since 1900 in Iowa, Kansas, Minnesota, and Tennessee. The greatest advance has been in Kansas, where the value of products has increased more than twentyfold. In Iowa, the value of products has increased 78.4 per cent; in Minnesota, 63.6 per cent; and in Tennessee, 65.9 per cent.

The industry in cities.—In the report upon this industry at the census of 1900 a table was presented summarizing the returns for the cities in which this industry was an important factor. Table 4 presents the main statistics of the industry, as reported at the census of 1905, in cities of 20,000 population or over. The remarkable consolidation which has been in progress renders it necessary to include several of the cities shown in 1900 with "all other cities" in 1905.

TABLE 4.—SUMMARY FOR CITIES HAVING A POPULATION IN 1900 OF 20,000 OR OVER: 1905.

CITY.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
			Number.	Salaries.	Average number.	Wages.			
Total	172	$114,539,659	3,916	$4,168,950	26,867	$14,498,587	$7,527,340	$28,463,530	$63,787,418
Canton, Ohio	5	2,421,469	67	75,795	525	238,644	173,366	533,039	1,154,239
Dayton, Ohio	4	1,778,762	47	54,211	359	187,937	180,648	487,109	1,014,321
Decatur, Ill	5	339,182	20	23,465	120	63,353	18,004	178,882	326,183
Detroit, Mich	3	848,282	98	82,256	255	121,379	261,143	433,719	939,657
Evansville, Ind	4	456,223	27	28,940	179	91,564	32,360	172,758	402,880
Indianapolis, Ind	6	324,744	28	26,250	86	39,928	34,965	80,824	242,339
Kansas City, Mo	3	375,924	26	36,370	113	59,526	7,784	121,182	303,648
La Crosse, Wis	5	904,650	34	40,599	256	118,691	85,329	260,956	542,425
Minneapolis, Minn	6	371,775	31	28,690	148	69,900	36,174	177,649	387,834
Moline, Ill[1]	4	18,218,130	258	408,529	2,199	1,353,187	1,255,637	4,129,411	8,347,014
Norfolk, Va	3	171,286	10	9,890	163	57,916	10,559	76,365	199,392
Peoria, Ill	6	4,615,744	155	195,814	946	560,953	276,546	1,007,653	2,309,962
Quincy, Ill	3	312,921	26	26,876	152	72,559	47,121	148,207	343,865
Racine, Wis	8	12,090,893	705	682,106	1,485	807,611	1,737,228	1,397,077	5,177,079
Rockford, Ill	4	970,274	32	35,990	386	219,740	265,285	631,022	1,161,036
South Bend, Ind	4	2,636,883	122	163,635	1,559	855,488	261,086	1,158,664	2,744,001
Springfield, Ohio	9	11,453,519	332	376,339	1,746	946,051	485,777	1,783,390	4,051,167
York, Pa	5	1,475,441	76	71,414	809	318,953	116,328	637,245	1,263,635
All other cities[2]	85	54,773,557	1,822	1,801,781	15,381	8,315,207	2,243,000	15,048,378	32,876,741

[1] Population less than 20,000 in 1900, but the city is included in this table on account of its importance in the industry.

[2] Includes establishments distributed as follows: Akron, Ohio, 1; Albany, N. Y., 1; Anderson, Ind., 1; Atlanta, Ga., 1; Auburn, N. Y., 4; Bay City, Mich., 2; Binghamton, N. Y., 1; Boston, Mass., 1; Buffalo, N. Y., 1; Cedar Rapids, Iowa, 1; Chattanooga, Tenn., 2; Chicago, Ill., 6; Cleveland, Ohio, 1; Columbus, Ohio, 3; Council Bluffs, Iowa, 2; Dallas, Tex., 2; Denver, Colo., 1; Duluth, Minn., 1; East St. Louis, Ill., 1; Elmira, N. Y., 1; Harrisburg, Pa., 1; Jackson, Mich., 2; Joliet, Ill., 2; Kalamazoo, Mich., 2; Kansas City, Kans., 1; Los Angeles, Cal., 2; Louisville, Ky., 3; Macon, Ga., 1; Milwaukee, Wis., 4; New York, N. Y., 1; Oakland, Cal., 1; Omaha, Nebr., 1; Petersburg, Va., 1; Philadelphia, Pa., 2; Portland, Me., 1; Poughkeepsie, N. Y., 2; Richmond, Va., 2; Saginaw, Mich., 1; St. Joseph, Mo., 1; St. Louis, Mo., 2; St. Paul, Minn., 2; Salem, Mass., 1; San Francisco, Cal., 1; Springfield, Ill., 2; Syracuse, N. Y., 2; Toledo, Ohio, 2; Topeka, Kans., 1; Trenton, N. J., 2; Utica, N. Y., 2; Worcester, Mass., 2; Zanesville, Ohio, 1.

Of the establishments reported at the census of 1905, 26.5 per cent were located in the above cities. These plants returned 58.2 per cent of the entire capital invested in the industry and 56.9 per cent of the total value of products. The average capital per establishment for these cities was $665,928, and the average value of products was $370,857, while for all agricultural work outside of these cities the average capital and the average value of products per establishment was $172,691 and $101,302, respectively.

Chicago ranked first, but it has been included in "all other cities" in order not to disclose individual operations. Auburn, N. Y.; Columbus, Ohio; Louisville, Ky.; and Milwaukee, Wis., have also been so included for the same reason. The preeminence of Chicago is due chiefly to the extensive manufacture of harvesting machines, in which it leads all cities of the world. It also produced 69.4 per cent of the grain harvesters, 67.5 per cent of the headers and binders, 61.5 per cent of the mowers, 58.8 per cent of the reapers, 20.7 per cent of the corn harvesters, and 46.2 per cent of the horse hayrakes manufactured in the United States.

Although the population of Moline in 1900 was less than 20,000, the city is included in Table 4 on account of its importance in the industry, in which it ranks second. By far the greater value of its manufactures of agricultural implements was in implements of cultivation, viz, $5,945,108, or 71.2 per cent of the total value of all agricultural implements manufactured in the city.

Products.—Illinois leads in the production of most of the principal agricultural implements, some of the notable exceptions being horse hayforks, scythes, and thrashers. Of the first, Ohio contributes almost the

whole product, but in the manufacture of scythes Maine leads, followed by New York. The scythe, in fact, appears to be a distinctively Eastern product, being contributed in 1905, entirely by Maine, Connecticut, Vermont, New York, and New Hampshire. Iowa, which had a small product in 1900, reported none in 1905. The manufacture of thrashers centers in Michigan and Wisconsin, which together contributed about one-third the total number, but in 1905 the former reported an increasing and the latter a decreasing product.

Table 5 shows by states the number and kind of the principal agricultural implements reported at the census of 1905.

The total value of products, classified according to kind, is shown by states in Table 6.

TABLE 5.—NUMBER AND KIND OF PRINCIPAL AGRICULTURAL IMPLEMENTS MANUFACTURED, BY STATES: 1905.

STATE.	Cultivators.	Harrows.	Plows.	Planters and drills.	Harvesters, headers, and binders.	Horse hayforks.	Horse hayrakes.	Mowers.	Scythes.	Thrashers, horsepower and steam-power.
United States	555,720	453,173	1,258,441	446,053	119,560	62,801	236,297	267,692	705,025	10,187
California	599	557	2,362	71	264	2,190	371			8
Connecticut	100	4,000	700						79,026	
Georgia	9,364	4,789	130,453	27,706						
Illinois	192,122	157,798	268,787	108,691	79,682		120,926	170,826		513
Indiana	10,489	1,808	265,258	21,288			880			1,031
Iowa	7,836	2,115	6,197	397	499	1,673	12,568			60
Kansas	3,615	800	2,309	2,010	105		110			
Kentucky	10,000	2,000	140,847	48,038	1,075					
Maine	718	212	1,248						253,791	11
Massachusetts	2,951	1,280	4,431	1,293			942	1,565		2
Michigan	25,663	26,291	25,058	106,173	1,302		378			2,150
Minnesota		3,134	1,713	3,257	1,208		496	930		859
Mississippi	8,500	450	415	2,500						
Missouri	9,411	455	626	1,232			12,000			18
Nebraska				1,000						
New Hampshire			295						72,004	
New Jersey	15,034	7,622	65	979		200				37
New York	27,467	126,817	90,802	16,861	22,292	750	39,844	57,919	240,204	700
North Carolina	6,455	90	4,010	4,800						
Ohio	109,576	72,480	125,611	66,859	5,512	55,000	36,262	19,382		976
Pennsylvania	71,139	4,553	48,497	4,672	2					1,563
South Carolina				260						
Tennessee		692	39,332	6,200						
Texas			19,191				30			
Vermont			2,080						60,000	203
Virginia	5,900	5,250	31,248	1,950						
Wisconsin	33,541	29,255	43,115	19,815	7,594	2,988	11,140	17,070		1,975
All other states[1]	5,240	725	3,791	1	25		350			81

[1] Includes states as follows: Alabama, Arkansas, Colorado, Maryland, North Dakota, Oregon, South Dakota, Utah, Washington, West Virginia.

TABLE 6.—KIND AND VALUE OF PRODUCTS, BY STATES: 1905.

STATE.	Total value.	Seeders and planters.	Implements of cultivation.	Harvesting implements.	Seed separators.	Miscellaneous.	All other products	Amount received for repair work, etc.
United States	$112,007,344	$11,225,122	$30,607,960	$30,862,435	$6,639,883	$19,534,114	$11,169,534	$1,968,296
California	1,483,746	12,260	123,717	413,262	3,015	267,475	326,487	337,530
Connecticut	269,743	600	226,662	29,880		998	11,603	
Georgia	1,039,671	162,957	424,580		5,875	128,206	310,806	7,247
Illinois	38,412,452	2,998,075	12,273,939	16,874,413	915,095	2,532,881	2,634,487	183,562
Indiana	8,060,575	694,047	3,346,695	138,533	718,575	2,513,607	520,650	128,468
Iowa	2,692,212	269,957	497,435	868,104	277,189	310,950	446,118	22,459
Kansas	395,262	49,050	132,742	12,470	750	113,770	79,500	6,980
Kentucky	2,190,917	484,709	1,638,150	3,050	9,766	42,980	10,262	2,000
Maine	205,650	325	22,022	117,579	2,500	3,107	52,967	7,150
Massachusetts	654,051	133,002	166,057	108,328	14,968	65,889	119,807	46,000
Michigan	8,719,719	1,004,734	1,313,564	530,215	1,479,173	2,824,237	1,453,419	114,377
Minnesota	2,885,055	272,876	83,936	148,397	535,246	1,229,401	382,460	232,739
Mississippi	38,000	5,000	33,000					
Missouri	1,068,008	40,115	226,333	291,189	45,389	362,821	85,882	16,279
Nebraska	46,000	36,000	7,500			2,500		
New Hampshire	61,860		3,950	47,600			9,500	810
New Jersey	391,926	74,912	187,243	2,000	14,133	85,401	19,047	9,190
New York	13,045,891	1,800,182	2,545,947	5,841,389	461,814	1,410,520	889,596	96,443
North Carolina	126,865	24,000	46,070	1,100		8,495	33,225	13,975
Ohio	12,891,197	2,016,919	3,031,384	3,193,853	501,482	2,430,577	1,193,560	523,422
Pennsylvania	5,016,679	186,449	987,619	393,917	489,956	2,229,802	658,270	70,666
South Carolina	34,932	3,215	192			20,000	10,725	800
Tennessee	768,895	12,000	545,076	5,806	40,000	87,685	70,293	8,035
Texas	187,134		156,074	700		3,800	26,450	110
Vermont	441,671		40,829	263,270	26,569	96,602	11,035	3,366
Virginia	404,281	32,225	189,287	1,465	16,800	3,295	152,279	8,930
Wisconsin	10,076,760	911,438	2,219,657	1,541,020	1,035,688	2,742,225	1,547,331	79,401
All other states[1]	398,192	75	138,300	34,895	45,900	16,890	113,775	48,357

[1] Includes states as follows: Alabama, Arkansas, Colorado, Maryland, North Dakota, Oregon, South Dakota, Utah, Washington, West Virginia.

Implements of cultivation and harvesting, which together form more than one-half of the total value of products, are by far the most important classes, and are thus obviously the staple articles at the present time in this industry. It is of interest therefore to analyze the geographic location of these products. Seven states, all except Kentucky bordering the Great Lakes, reported approximately four-fifths of the value of implements of cultivation, and four—Illinois, New York, Ohio, and Wisconsin—nine-tenths of the value of harvesting implements. These values combined represent nearly 50 per cent of the total value of products. Unfortunately no comparison with 1900 is possible as this segregation was not made at that census.

It is from harvesting implements that Illinois derives supremacy in the industry, although this state also leads in value of products of implements of cultivation. New York and Illinois produced 73.6 per cent of the total value of harvesting implements manufactured. The preponderance of the value of these implements in the two leading states is noteworthy. It was the large value of this class of products in New York which enabled that state to outrank Ohio, since Ohio surpassed New York in the value of every other class of implements produced.

In value of implements of cultivation Indiana is second, closely followed by Ohio and New York. Kentucky, Michigan, and Wisconsin also passed the million dollar mark.

Table 7 compares the number and kind of implements manufactured as reported at each census from 1870 to 1905.

TABLE 7.—*Comparative summary—number and kind of agricultural implements manufactured: 1870 to 1905.*

KIND.	1905	1900	1890	1880	1870
Seeders and planters:					
Planters—					
Bean	7,210	200			
Corn—					
Hand	86,553	129,515	77,501	68,691	21,709
Horse	83,719	78 135	54,639		
Cotton	127,052	45,575	56,740	19,288	2,000
Potato	35,756	25,338			
Drills—					
Beet	606	5,302			
Corn	28,228	21,940			
Grain	76,929	91,635	44,830	43,222	32,033
Grain sowers	33,546	36,862	16,728	15,563	
Lime spreaders	521	474			
Listers	23,012	26,995	18,603		
Manure spreaders	22,236	5,263		[1] 8.155	
Seed sowers	59,910	83,283	57,716	20,289	6,900
Tobacco transplanters	1,142	3,788		4,245	
Implements of cultivation:					
Cultivators—					
Bean	232	189			
Beet	3,459	2,008			
Small	238,941	206,982	239,008	[2] 318,057	88,740
Wheeled	313,088	295,799	206,482		
Celery hillers	1,070	130			
Cotton scrapers	22,519	15,230			
Cotton sweeps	8,098	75,311			
Equalizers	67,852	74,168			
Harrows—					
Disk	104,323	97,261	53,980		
Other than disk	348,850	380,259	214,985		9,150
Hoes, dozens	331,620	277,173	254,814	299,338	135,139
Markers and furrowers	5,512	854			

[1] Classified as "fertilizer distributers."
[2] Not reported separately.

TABLE 7.—*Comparative summary—number and kind of agricultural implements manufactured: 1870 to 1905*—Continued.

KIND.	1905	1900	1890	1880	1870
Implements of cultivation—Continued.					
Plows—					
Disk	39,146	17,345			
Shovel	121,899	102,320			
Steam	1,599	207			
Sulky or wheel	138,899	136,105	67,286		
Walking	956,898	819,022	1,182,059	1,326,123	864,947
Potato coverers and hillers	2,938	3,052			
Rollers	22,188	12,590	5,168	3,002	4,803
Stalk cutters	15,146	13,425	21,605		
Harvesting implements:					
Grain cradles	30,056	36,163	84,222	167,492	103,646
Harvesters and binders and headers, grain	108,810	233,542	125,942		3,566
Harvesters—					
Bean	665	1,425			
Corn	6,924	20,707			
Other	3,161	6,283	3,429	[1] 25,737	
Hay carriers	85,121	54,303	24,351		
Hayforks—					
Hand, dozens	345,297	152,840	[2] 264,742	206,727	108,188
Horse	62,801	51,770	1,823		
Hay loaders	27,174	7,273	3,019	8,957	
Hayrakes—					
Hand, dozens	76,139	58,013	64,825	308,732	207,310
Horse	236,297	216,345	114,790	95,625	80,619
Hay stackers	8,670	12,069	5,184		
Hay tedders	35,745	14,510	12,176	2,334	
Mowers	267,692	397,561	170,893	72,090	39,486
Mowers and reapers combined	5,693	1,055	15,681	54,920	59,645
Potato diggers	11,703	21,033	4,816	33,453	
Potato hooks	139,940	20,860			
Reapers	60,996	35,945	8,834	35,327	60,388
Scythes	705,025	718,453	795,400	1,244,264	881,244
Scythe snaths	699,636	537,214	511,856	437,178	17,680
Sickles	247,716	446,660		95,613	3,600
Stackers	845	247			
Seed separators:					
Bean separators	727	40			
Other separators	12,109	1,707	4,577	9,103	1,131
Clover hullers	351	661	651	1,412	5,206
Corn huskers	1,327	10,726		44,370	
Cornshellers—					
Hand	47,189	106,381	85,438	59,157	12,941
Power	6,082	8,185	5,726		
Fanning mills	22,994	30,369	21,460	45,412	19,772
Thrashers—					
Horsepower	2,237	1,314	2,769		
Steampower	7,950	3,651	2,661	[3] 10,424	[3] 22,931
Thrashers and separators combined		5,394	5,937		

[1] Harvesters of all kinds, not reported separately.
[2] Hay, manure, and spading forks, hand; not reported separately.
[3] Not reported separately.

General comparisons only are possible with the reports previous to 1900, owing to the difference in the schedules used before and since that census. The heads and subheads in the table are those of the schedule of inquiry for the census of 1905, and are almost identical with those of the 1900 schedule. For these years, therefore, a fair comparison can be made. At the three earlier censuses, however, the form varied materially and was much less comprehensive. Articles were put under one head which in the later censuses came under two or more heads, and some implements, manufactured only on a small scale, were left out altogether. Moreover at the later censuses there was naturally a greater variety of implements. Comparison of these earlier censuses with the later ones is, therefore, often misleading.

Horse corn planters increased steadily from 1890 to 1905, while the number of hand corn planters advanced from 1870 to 1900 and then declined. Of implements classed as seeders and planters, bean planters, cotton

planters, and manure spreaders have made the most marked gains since 1900, and of implements of cultivation, beet cultivators, celery hillers, markers and furrowers, steam and disk plows, and rollers, the greatest proportional increase. Disk harrows show an increase over 1900, while all other varieties show a decline.

The advance of over 54,000 dozens since 1900 in the number of hoes manufactured, indicates that no labor-saving device has yet been invented to supplant this simple and useful instrument.

The more important harvesting implements show a decrease in number. The falling off in harvesters and mowers, however, should not be interpreted as indicating a decline in the use of such implements, for a greater number of improved harvesting machines are in use to-day than ever before. The decrease in number manufactured may be accounted for, in part, by the fact that important manufacturers in Illinois and Ohio reported a greater "carryover" from the year 1903 than ever before. Also most of the large farms are now supplied with elaborate labor-saving devices, and as these are standardized so that when repair is needed the worn-out part may be easily replaced, new machines are not required for a long period of time.

The output of scythes has decreased steadily since 1880. Except in very rough and hilly regions, the scythe has been displaced by mowing machines, which require less labor. Mechanical motive power has been successfully adapted to use in mowing machines and the auto-mower is now a frequent sight in city parks.

Table 8 shows the number of establishments reporting each kind of implement with the number of each kind manufactured at the census of 1905.

TABLE 8.—*Number of establishments reporting each kind of implement, with the total number manufactured: 1905.*

KIND.	Number of establishments.	Number of implements.
Seeders and planters:		
Planters—		
Bean	7	7,210
Corn—		
Hand	10	86,553
Horse	48	83,719
Cotton	36	127,052
Potato	18	35,756
Drills—		
Beet	6	606
Corn	25	28,228
Grain	39	76,929
Grain sowers	29	33,546
Lime spreaders	3	521
Listers	21	23,012
Manure spreaders	22	22,236
Seed sowers	28	59,910
Tobacco transplanters	4	1,142
All other	15	22,063
Implements of cultivation:		
Cultivators—		
Bean	5	232
Beet	11	3,459
Small	79	238,941
Wheeled	[illegible]	313,088
Celery hillers	6	1,070
Cotton scrapers	10	22,519
Cotton sweeps	5	8,098
Equalizers	12	67,852
Harrows—		
Disk	55	104,323
Spring-tooth	35	86,408
Spike-tooth	106	262,442
Hoes, dozens	22	331,620
Markers and furrowers	12	5,512

TABLE 8.—*Number of establishments reporting each kind of implement, with the total number manufactured: 1905*—Continued.

KIND.	Number of establishments.	Number of implements.
Implements of cultivation—Continued.		
Plows—		
Disk	29	39,146
Shovel	62	121,899
Steam	5	1,599
Sulky or wheel	52	138,899
Walking	155	956,898
Potato coverers and hillers	14	2,938
Rollers	58	22,188
Stalk cutters	34	15,146
All other	10	12,480
Harvesting implements:		
Grain cradles	18	30,056
Harvesters and binders and headers, grain	21	108,810
Harvesters—		
Bean	5	665
Corn	17	6,924
Other	8	3,161
Hay carriers	19	85,121
Hayforks—		
Hand, dozens	17	345,297
Horse	10	62,801
Hay loaders	11	27,174
Hayrakes—		
Hand, dozens	23	76,139
Horse	64	236,297
Hay stackers	26	8,670
Hay tedders	16	35,745
Mowers	19	267,692
Mowers and reapers combined	3	5,693
Potato diggers	31	11,703
Potato hooks	8	139,940
Reapers	10	60,996
Scythes	8	705,025
Scythe snaths	11	699,636
Sickles	3	247,716
Stackers	4	845
All other	12	6,659
Seed separators:		
Bean separators	6	727
Other separators	15	12,109
Clover hullers	4	351
Corn huskers	21	1,327
Cornshellers—		
Hand	27	47,189
Power	21	6,082
Fanning mills	22	22,994
Thrashers—		
Horsepower	32	2,237
Steampower	37	7,950
All other	6	1,182
Miscellaneous:		
Bean pullers	6	1,587
Cane mills	4	2,996
Carts	11	21,365
Check rowers	4	12,478
Corn cleaners	2	106
Corn hooks	8	44,628
Corn knives	8	125,149
Cotton gins	3	72
Cotton presses	2	18
Ensilage cutters	20	10,696
Engines and boilers	6	369
Farm trucks	16	4,320
Gardening implements	27	494,034
Grubbing machines	5	1,043
Hand carts	15	9,359
Hay-cutters	13	29,283
Hay presses	24	5,719
Hayracks	3	620
Horsepowers	43	4,804
Lawn mowers	2	34,000
Pea hullers	7	1,706
Portable sawmills	19	1,828
Portable steam engines	13	1,190
Pumps—		
Hand	5	81,765
Horse	1	1,000
Steam	2	165
Road carts	4	373
Shovels, spades, and scoops	3	868,899
Singletrees	15	220,549
Sirup evaporators	1	768
Sorghum evaporators	3	2,447
Straw stackers	29	8,034
Thrasher trucks	11	1,269
Traction engines	23	6,165
Wagons	23	7,027
Wagon trucks	2	54
Water trucks	16	2,077
Weeders	21	12,224
Windmills	4	2,009

The tendency of establishments toward specialization is shown by an increase in the numbers of certain kinds of implements manufactured with a corresponding decrease in number of establishments reporting.

This was the case in connection with the following implements: Horse corn-planters, small and wheeled cultivators, disk harrows, shovel and walking plows, rollers, horse hayforks, hay loaders, hayrakes, and reapers.

The fourfold increase in the number of mowers and reapers combined is particularly marked when it is considered that the same number of establishments manufactured these in both years.

Attention is called to the list of implements enumerated under the heading "miscellaneous." Some of them are semiagricultural and not closely connected with the tilling of the soil, but are included because made in establishments manufacturing agricultural implements as their principal product.

All the foregoing statistics refer to establishments engaged exclusively or primarily in the manufacture of agricultural implements. The extent to which agricultural implements were manufactured as a minor product in connection with other industries is shown in Table 9.

TABLE 9.—INDUSTRIES MANUFACTURING AGRICULTURAL IMPLEMENTS AS A MINOR PRODUCT, WITH NUMBER OF ESTABLISHMENTS AND VALUE OF SUCH PRODUCTS, BY KINDS: 1905.

INDUSTRY.	Number of establishments.	VALUE OF PRODUCTS.						
		Total.	Seeders and planters.	Implements of cultivation.	Harvesting implements.	Seed separators.	All other agricultural implements and parts.	Amount received for repair work, etc.
Aggregate	741	$113,357,023	$11,450,958	$30,889,085	$31,030,843	$7,012,698	$30,961,391	$2,012,048
Agricultural implements	648	112,007,344	11,225,122	30,607,960	30,862,435	6,639,883	30,703,648	1,968,296
Industries otherwise classified	93	1,349,679	225,836	281,125	168,408	372,815	257,743	43,752
Foundry and machine shop products	54	823,412	123,804	216,917	48,945	207,561	204,621	21,564
Carriages and wagons	24	308,569	63,332	59,858	6,740	143,129	15,762	19,748
Lumber, planing mill products	5	53,748	1,000		31,823	9,025	9,560	2,340
All other[1]	10	163,950	37,700	4,350	80,900	13,100	27,800	100

[1] Includes establishments distributed as follows: Cordage and twine, 1; dairymen's, poulterers', and apiarists' supplies, 2; galvanizing, 2; iron and steel forgings, 1; steam fittings and heating apparatus, 1; structural ironwork, 1; wood, turned and carved, 1; woodenware, not elsewhere specified, 1.

In view of the close relation between foundry and machine shop products and agricultural implements, it is but natural to find in that industry the greatest number of plants manufacturing agricultural implements as a minor product and the greatest value of this product.

The value of agricultural implements manufactured as a minor product by establishments in other industries forms but a small part of the aggregate value. Seed separators are in value the most important agricultural implements made by such establishments.

The 741 establishments engaged in the manufacture of agricultural implements, either as a principal or a subsidiary product, with their total value of products of $113,357,023, represent the actual extent of this manufacture in the United States during the calendar year 1904, so far as can be ascertained from the various schedules returned.

In addition to the 648 establishments reported at the census of 1905 as actively engaged in the manufacture of agricultural implements as a principal product, 8 idle establishments were reported, with a capital of $242,400. These idle establishments embrace plants that were once in operation but not operated during the census year.

Table 10 shows the number of establishments producing agricultural implements as a subsidiary product and the value of such products distributed by states.

TABLE 10.—*Establishments manufacturing agricultural implements as a minor product, and value of such products, by states: 1905.*

STATE.	Number of establishments.	Value of products.
Total	93	$1,349,679
California	14	21,044
Illinois	7	144,006
Indiana	5	220,125
Kentucky	3	9,298
Michigan	5	28,001
Minnesota	5	60,673
Missouri	3	9,567
New York	7	54,119
North Carolina	3	5,375
Ohio	8	289,181
Pennsylvania	5	136,034
South Carolina	4	3,232
Vermont	4	16,600
Wisconsin	9	278,260
All other states[1]	11	74,164

[1] Includes establishments distributed as follows: Arkansas, 1; Connecticut, 1; Georgia, 1; Iowa, 1; Kansas, 1; Massachusetts, 1; Mississippi, 1; Texas, 1; Virginia, 2; Washington, 1.

These 93 plants, which were scattered over 24 states, do not cover all establishments in which a small quantity of agricultural implements or parts were produced, but only those which have separately reported finished implements in commercial quantities.

Of the states, California had by far the greatest number of plants; but the average value of product per establishment was only $1,503. Wisconsin ranked second in number of establishments, with an average value of product of $30,918. Ohio stood third in number of plants, but first in value of products. In

value of products, Wisconsin, Indiana, Illinois, and Pennsylvania followed in the order named.

Power.—Table 11 shows the different kinds of power employed by agricultural implement manufacturers at the censuses of 1900 and 1905.

TABLE 11.—*Power—comparative summary, with per cent each kind is of the total: 1905 and 1900.*

	1905		1900	
	Amount.	Per cent of total.	Amount.	Per cent of total.
Number of establishments reporting power	589	....	595	....
Total horsepower	106,623	100.0	77,189	100.0
Owned:				
Engines—				
Steam—				
Number	698	....	678	....
Horsepower	75,018	70.4	61,147	79.2
Gas and gasoline—				
Number	165	....	75	....
Horsepower	2,360	2.2	1,055	1.4
Water wheels—				
Number	128	....	159	....
Horsepower	6,288	5.9	6,758	8.8
Water motors—				
Number	4	....	(1)	....
Horsepower	12	(2)	(1)	....
Electric motors—				
Number	690	....	193	....
Horsepower	16,885	15.8	6,543	8.5
Other power, horsepower	2,157	2.0	320	0.4
Rented:				
Electric motors—				
Number	182	....	(1)	....
Horsepower	3,828	3.6	1,100	1.4
Other kind, horsepower	75	0.1	266	0.3
Furnished to other establishments, horsepower	751	....	338	....

[1] Not reported.
[2] Less than one-tenth of 1 per cent.

The total horsepower used increased 38.1 per cent between 1900 and 1905. To this increase steam engines and electric motors were the largest contributers. The horsepower of the latter in 1905 was between two and three times as great as in 1900. Gas and gasoline engines, although they have more than doubled in number and horsepower, still form a very small proportion of the total. The only decreases reported are those for water wheels and "other kind" of rented power, 7 and 71.8 per cent, respectively.

Patents in relation to agricultural implements.—The following is a list of patents granted to June 5, 1906:

TABLE 12.—*Patents granted to June 5, 1906.*

CLASS.	Total.	Jan. 1, 1902, to June 5, 1906.	Prior to 1902.
Total	46,729	4,828	41,901
Plows: Including cotton choppers and scrapers, cultivators, etc., parts and attachments	12,799	1,175	11,624
Harrows and diggers: Including clod crushers, forks, hoes, land rollers, potato diggers, rakes, shovels, stalk choppers, transplanters, etc., parts and attachments	6,430	944	5,486
Seeders and planters: Including broadcast, checkrow, drills, fertilizer distributers, etc., parts and attachments	9,411	862	8,549
Harvesters: Including binders, fruit gatherers, hand binders, hay loaders, horse rakes, mowers, scythes, and cradles, etc., parts and attachments	12,431	1,136	11,295
Separators and thrashers: Including band cutters and feeders, cane strippers, clover hullers, corn husking machines and implements, cornshellers, fruit and vegetable separators, etc., parts and attachments	5,658	711	4,947

Exports.—The exportation of agricultural implements is one of the most important branches of the American export trade in manufactured articles, ranking fourteenth among all classes. Compared with the value of the other classes of exported machinery agricultural implements are far in the lead, being nearly twice as great as that of carriages, cars, other vehicles, etc.; and builders' hardware and saws and tools. The United States leads the world in the exportation of agricultural implements, with the United Kingdom as its principal competitor.

Table 13 shows the value of agricultural implements exported each year from 1900 to 1905; distributed by class and country.

TABLE 13.—VALUE OF EXPORTS OF AGRICULTURAL IMPLEMENTS: YEARS ENDING JUNE 30, 1900 TO 1905.[1]

CLASS AND COUNTRY.	1905	1904	1903	1902	1901	1900
Aggregate	$20,721,741	$22,749,635	$21,006,622	$16,286,740	$16,313,434	$16,099,149
Mowers, reapers, and parts of:						
Total	10,559,891	11,568,062	10,326,641	8,818,370	9,943,680	11,243,763
France	2,556,573	2,666,602	2,420,428	1,428,823	1,459,807	2,652,795
Germany	1,015,385	1,042,176	775,674	1,153,933	1,660,946	2,529,422
Russia	2,589,457	2,341,199	2,015,374	1,698,794	1,295,277	710,066
United Kingdom	402,970	908,862	788,247	708,379	1,435,330	982,188
Canada, Newfoundland, and Labrador	499,206	1,265,471	1,918,342	1,729,873	1,259,570	1,192,458
Argentina	1,472,156	1,289,412	635,549	689,509	805,703	1,194,961
British Australasia	476,112	510,797	416,571	271,502	384,411	466,397
All other countries	1,548,032	1,543,543	1,356,456	1,137,557	1,642,636	1,515,476
Plows, cultivators, and parts of:						
Total	2,892,060	3,537,810	3,169,961	2,791,092	1,888,373	2,178,098
France	55,723	95,285	87,501	396,098	124,957	68,197
Germany	31,899	31,611	26,143	158,055	65,172	227,378
Russia	224,551	205,391	42,299	34,961	126,469	45,993
United Kingdom	121,699	150,714	53,402	158,652	98,513	179,950
Canada, Newfoundland, and Labrador	364,409	523,771	534,788	366,098	234,108	247,306
Argentina	805,136	1,146,267	1,003,880	621,802	369,522	388,903
British Australasia	215,527	250,078	131,141	264,682	151,170	162,109
All other countries	1,073,116	1,134,693	1,290,807	790,744	718,462	858,262
All other implements, and parts of:						
Total	7,269,790	7,643,763	7,510,020	4,677,278	4,481,381	2,677,288
France	205,702	301,865	281,327	276,776	483,513	189,583
Germany	198,817	505,239	617,266	556,684	951,201	129,654
Russia	1,048,653	861,468	1,578,472	664,201	270,851	274,671
United Kingdom	543,712	864,603	580,983	320,618	361,549	188,305
Canada, Newfoundland, and Labrador	1,035,300	1,572,871	1,570,727	1,027,689	633,426	571,442
Argentina	2,755,561	1,560,797	1,181,828	628,511	245,353	221,880
British Australasia	468,294	794,210	720,451	428,328	471,319	269,776
All other countries	1,013,751	1,182,710	978,966	774,471	1,064,169	831,977

[1] Bureau of Statistics, Department of Commerce and Labor, "Commerce and Navigation of the United States."

In the fifteen years 1890 to 1905 the extension of trade to foreign countries has been very great. The value of exports during the fiscal year 1905 formed 18.5 per cent of the total value of products for the census of 1905; for 1900 the ratio was 15.9 per cent. The absolute increase in value from 1900 to 1905 was more than $4,000,000 and from 1890 to 1905 between $16,000,000 and $17,000,000.

The value of agricultural implements exported during the fiscal years 1870, 1880, and 1890, together with their percentages of the total value of products of the industry for the census years 1870, 1880, and 1890, are as follows: 1870, $1,068,476, or 2.1 per cent; 1880, $2,245,742, or 3.3 per cent; and 1890, $3,859,184, or 4.7 per cent.

Almost every agricultural country in the world imports American implements in quantities governed by its industrial and economic condition. The use of labor-saving machinery for agricultural purposes naturally depends largely on the cost of labor. This was revealed by the 54 replies received from United States consuls to a Department circular sent at the request of the National Association of Agricultural Implement and Vehicle Manufacturers, which indicated that where the cost of farm labor is low very few agricultural implements are used. The higher the wage the greater the demand for the up to date implements.

Russia and Argentina, the two great wheat producing countries, were in 1905 the leading importers of American agricultural machinery. Russia received 18.6 per cent of the total value of all exports, nearly four times as much as in 1900, and Argentina 24.3 per cent, an actual increase since 1900 of 178.7 per cent.

Of all the economy effected by labor-saving machines, the saving resulting from the use of machines in harvesting the corn and wheat crops is greater than any other, and that obtained in the harvesting of the wheat crop probably greatest. Moreover, evidence confirming the statement already made that the demand is intensified in countries where labor is expensive or hard to obtain is found in the report of the American consul at Odessa in 1903 where he writes that at that time labor was so scarce in many places that troops were sent to work in the fields. In Argentina the scarcity and consequent high price of labor renders the use of labor-saving machinery a necessity. Much of the land suitable for wheat growing in that country is not as yet under cultivation, and in the opening up of this land lies an opportunity for agricultural implements similar to, though less extensive than, that which came from the opening up of the West.

DIAGRAM 2.—*Growth of the total value of exports and of total value of exports to specified countries: 1890 to 1905.*

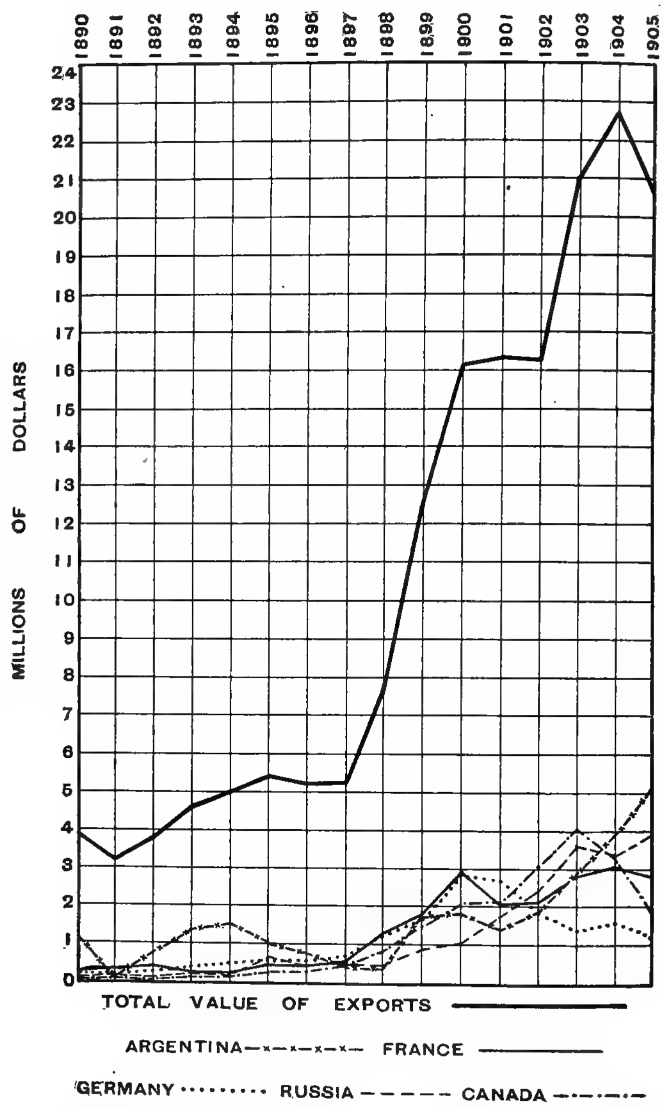


Table 14, which follows, is a full statement by states of the agricultural implement industry as reported at the census of 1905.

TABLE 14.—AGRICULTURAL IMPLEMENTS—

		United States.	California.	Connecticut.	Georgia.	Illinois.
1	Number of establishments	648	25	3	16	82
2	Capital, total	$196,740,700	$2,240,143	$320,374	$792,004	$71,383,289
3	Land	$12,648,650	$158,198	$11,600	$13,650	$6,118,380
4	Buildings	$26,547,150	$201,928	$75,000	$157,449	$10,689,969
5	Machinery, tools, and implements	$26,036,717	$248,276	$148,892	$208,372	$11,588,525
6	Cash and sundries	$131,508,183	$1,631,741	$84,882	$412,533	$42,986,415
7	Proprietors and firm members	496	19	2	16	43
	Salaried officials, clerks, etc.:					
8	Total number	7,199	87	17	35	1,929
9	Total salaries	$7,572,646	$99,440	$17,148	$44,124	$2,152,293
	Officers of corporations—					
10	Number	607	8	5	7	126
11	Salaries	$1,481,818	$16,200	$5,808	$16,600	$429,389
	General superintendents, managers, clerks, etc.—					
12	Total number	6,592	79	12	28	1,803
13	Total salaries	$6,090,828	$83,240	$11,340	$27,524	$1,722,904
	Men—					
14	Number	5,889	69	9	27	1,588
15	Salaries	$5,767,189	$78,622	$10,352	$27,104	$1,619,469
	Women—					
16	Number	703	10	3	1	215
17	Salaries	$323,639	$4,618	$988	$420	$103,435
	Wage-earners, including pieceworkers, and total wages:					
18	Greatest number employed at any one time during the year	62,979	706	207	852	20,273
19	Least number employed at any one time during the year	29,513	256	76	306	10,113
20	Average number	47,394	479	181	584	15,359
21	Total wages	$25,002,650	$348,531	$81,698	$170,723	$8,851,404
	Men 16 years and over—					
22	Average number	46,631	473	175	550	14,914
23	Wages	$24,777,846	$347,101	$80,278	$166,607	$8,703,660
	Women 16 years and over—					
24	Average number	579				441
25	Wages	$191,308				$147,003
	Children under 16 years—					
26	Average number	184	6	6	34	4
27	Wages	$33,496	$1,430	$1,420	$4,116	$741
	Average number of wage-earners, including pieceworkers, employed during each month:[1]					
	Men 16 years and over—					
28	January	51,543	524	188	749	16,585
29	February	53,639	559	189	742	16,940
30	March	53,836	559	188	669	16,741
31	April	51,648	604	190	538	15,690
32	May	48,431	603	177	439	15,029
33	June	44,799	444	169	325	13,455
34	July	40,435	366	70	291	11,735
35	August	39,781	349	164	416	12,211
36	September	39,160	345	176	482	12,454
37	October	41,813	435	196	560	14,929
38	November	45,311	437	196	663	16,043
39	December	49,176	451	197	726	17,156
40	Miscellaneous expenses, total	$15,178,098	$122,986	$16,253	$71,728	$3,960,647
41	Rent of works	$81,113	$1,425		$4,700	$19,528
42	Taxes	$714,836	$11,404	$2,029	$7,376	$208,349
43	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$14,248,729	$110,007	$14,224	$59,502	$3,717,542
44	Contract work	$133,420	$150		$150	$15,228
45	Materials used, aggregate cost	$48,281,406	$723,902	$117,420	$601,894	$17,750,852
46	Principal materials, total cost	$36,522,850	$470,884	$79,562	$377,781	$13,593,622
47	Purchased in raw state	$97,348				$312
48	Purchased in partially manufactured form	$36,425,502	$470,884	$79,562	$377,781	$13,593,310
49	Fuel	$1,756,298	$20,033	$15,730	$20,504	$677,209
50	Rent of power and heat	$46,872	$7,365		$145	$10,009
51	Mill supplies	$485,453	$3,583	$1,989	$1,997	$223,501
52	All other materials	$8,625,381	$168,362	$16,822	$187,117	$2,892,745
53	Freight	$844,552	$53,675	$3,317	$14,350	$353,766
54	Products, total value	$112,007,344	$1,483,746	$269,743	$1,039,671	$38,412,452
55	Seeders and planters	$11,225,122	$12,260	$600	$162,957	$2,998,075
56	Implements of cultivation	$30,607,960	$123,717	$226,662	$424,580	$12,273,939
57	Harvesting implements	$30,862,435	$413,262	$29,880		$16,874,413
58	Seed separators	$6,639,883	$3,015		$5,875	$915,095
59	Miscellaneous	$19,534,114	$267,475	$998	$128,206	$2,532,881
60	All other products	$11,169,534	$326,487	$11,603	$310,806	$2,634,487
61	Amount received for repair work, etc	$1,968,296	$337,530		$7,247	$183,562
	Kind and quantity of products, number of implements:					
	Seeders and planters—					
	Planters—					
62	Bean	7,210	61			780
	Corn—					
63	Hand	86,553				2,165
64	Horse	83,719				58,061
65	Cotton	127,052			27,507	31,256
66	Potato	35,756				461
	Drills—					
67	Beet	606				556
68	Corn	28,228				11,014
69	Grain	76,929	10		199	4,398
70	Grain sowers	33,546	676	100		12,191
71	Lime spreaders	521				
72	Listers	23,012				16,815
73	Manure spreaders	22,236			425	981
74	Seed sowers	59,910			600	1,422
75	Tobacco transplanters	1,142				
76	All other	22,063			18,039	1,475
	Implements of cultivation—					
	Cultivators—					
77	Bean	232	73			
78	Beet	3,459	2			1,906
79	Small	238,941	47		9,364	9,572
80	Wheeled	313,088	477	100		180,644

[1] The average numbers of women and children employed during each month, being small, are not shown in this table.

DETAILED SUMMARY, BY STATES: 1905.

Indiana.	Iowa.	Kansas.	Kentucky.	Maine.	Massachusetts.	Michigan.	Minnesota.	Mississippi.	
41	30	7	6	13	9	42	21	3	1
$14,523,167	$3,319,102	$629,439	$1,898,666	$393,859	$731,710	$14,342,106	$7,793,316	$38,650	2
$1,000,274	$114,373	$45,400	$166,300	$38,430	$7,400	$559,432	$136,366	$550	3
$2,283,839	$449,833	$92,200	$225,600	$60,850	$36,926	$1,410,165	$799,069	$4,600	4
$1,263,391	$349,677	$126,426	$246,400	$76,011	$99,127	$1,141,299	$642,551	$14,400	5
$9,975,663	$2,405,219	$365,413	$1,260,366	$218,568	$588,257	$11,231,210	$6,215,330	$19,100	6
15	19	9	4	14	7	26	10	5	7
389	231	32	129	19	27	713	249		8
$466,156	$204,277	$35,705	$135,092	$12,700	$35,804	$678,309	$319,375		9
42	29	5	8	2	3	64	28		10
$100,567	$40,848	$7,120	$28,600	$3,200	$12,000	$124,726	$74,745		11
347	202	27	121	17	24	649	221		12
$365,589	$163,429	$28,585	$106,492	$9,500	$23,804	$553,583	$244,630		13
318	177	23	115	13	19	568	200		14
$351,958	$153,301	$26,505	$103,292	$8,800	$21,720	$520,245	$234,148		15
29	25	4	6	4	5	81	21		16
$13,631	$10,128	$2,080	$3,200	$700	$2,084	$33,338	$10,482		17
4,322	1,632	175	1,204	201	502	4,110	1,696	35	18
2,608	720	26	796	84	340	1,736	522	19	19
3,543	1,027	105	970	153	418	3,164	1,176	22	20
$1,840,609	$469,690	$52,181	$438,101	$77,471	$212,586	$1,685,677	$637,232	$8,310	21
3,488	1,023	104	950	151	417	3,142	1,175	22	22
$1,823,786	$469,204	$52,056	$435,101	$76,850	$212,386	$1,681,545	$636,868	$8,310	23
42				2	1	2	1		24
$14,398				$621	$200	$725	$364		25
13	4	1	20			20			26
$2,425	$486	$125	$3,000			$3,407			27
3,529	923	134	1,037	163	425	3,459	1,426	19	28
3,937	978	136	1,015	164	448	3,497	1,492	19	29
3,962	1,017	118	990	182	463	3,572	1,396	17	30
3,921	1,052	108	865	181	469	3,425	1,378	15	31
3,780	1,076	110	813	174	472	3,186	1,375	16	32
3,694	1,082	114	801	151	444	3,166	1,301	24	33
3,458	1,210	59	846	98	423	3,128	1,238	23	34
3,300	1,173	59	857	103	361	2,953	1,141	23	35
3,015	1,106	86	904	151	375	2,982	1,028	25	36
2,923	954	90	1,049	164	370	2,529	817	29	37
2,977	884	112	1,073	163	372	2,781	652	28	38
3,360	821	122	1,150	118	382	3,026	856	23	39
$1,594,046	$337,149	$52,124	$316,892	$20,140	$63,554	$1,902,405	$541,739	$1,203	40
$1,920	$2,938			$322	$13,702	$2,682	$2,246	$240	41
$75,200	$12,463	$3,621	$13,163	$2,506	$6,994	$78,891	$21,413	$108	42
$1,515,638	$310,109	$48,253	$303,729	$17,312	$35,245	$1,788,096	$518,080	$855	43
$1,288	$11,639	$250			$7,613	$32,736			44
$2,975,468	$1,356,712	$204,522	$1,091,345	$75,565	$252,036	$3,497,210	$1,089,641	$13,630	45
$1,876,772	$942,293	$183,703	$961,018	$46,317	$198,633	$2,860,039	$598,940	$11,750	46
$49,718			$20,000	$481	$3,090	$2,783	$2,876		47
$1,827,054	$942,293	$183,703	$941,018	$45,836	$195,543	$2,857,256	$596,064	$11,750	48
$113,081	$26,274	$5,161	$29,969	$8,795	$9,231	$90,224	$58,553	$650	49
$6,724	$1,615	$100	$1,545	$448	$193	$8,371	$958		50
$17,708	$19,398	$2,713	$7,430	$604	$1,772	$31,929	$5,042	$25	51
$845,423	$341,216	$9,620	$87,244	$13,514	$37,145	$486,647	$420,806	$725	52
$115,760	$25,916	$3,225	$4,139	$5,887	$5,062	$20,000	$5,342	$480	53
$8,060,575	$2,692,212	$395,262	$2,190,917	$205,650	$654,051	$8,719,719	$2,885,055	$38,000	54
$694,047	$269,957	$49,050	$484,709	$325	$133,002	$1,004,734	$272,876	$5,000	55
$3,346,695	$497,435	$132,742	$1,638,150	$22,022	$166,057	$1,313,564	$83,936	$33,000	56
$138,533	$868,104	$12,470	$3,050	$117,579	$108,328	$530,215	$148,397		57
$718,575	$277,189	$750	$9,766	$2,500	$14,968	$1,479,173	$535,246		58
$2,513,607	$310,950	$113,770	$42,980	$3,107	$65,889	$2,824,237	$1,229,401		59
$520,650	$446,118	$79,500	$10,262	$52,967	$119,807	$1,453,419	$382,400		60
$128,468	$22,459	$6,980	$2,000	$7,150	$46,000	$114,377	$232,759		61
						6,324			62
						54,982			63
2,830	103		5,000		1,293	1,748			64
180		1,300	40,000			6,215		2,500	65
200		10				26,946			66
						14			67
6,595	244	550				592			68
11,483	50	150	3,038			9,352	3,257		69
8,517			4			3,195			70
					364				71
	1,051	1,035				282			72
	2,890				1,053	2,959			73
35,522				50	2,300	1,867	665		74
									75
804						485	110		76
						152			77
						826			78
5,400		15	5,000	718	2,851	12,367		8,500	79
5,089	7,836	3,600	5,000		100	12,318			80

TABLE 14.—AGRICULTURAL IMPLEMENTS—

		United States.	California.	Connecticut.	Georgia.	Illinois.
	Kind and quantity of products, number of implements—Continued.					
	Implements of cultivation—Continued.					
81	Celery hillers	1,070				20
82	Cotton scrapers	22,519			3,981	3,900
83	Cotton sweeps	8,098			2,026	867
84	Equalizers	67,852				52,550
	Harrows—					
85	Disk	104,323	171	4,000		44,418
86	Spring-tooth	86,408				1,200
87	Spike-tooth	262,442	386		4,789	112,180
88	Hoes, dozens	331,620		39,155		51
89	Markers and furrowers	5,512				4,033
	Plows—					
90	Disk	39,146	990	400		19,478
91	Shovel	121,899	30		4,674	5,977
92	Steam	1,599	20			23
93	Sulky or wheel	138,899	58	300		85,403
94	Walking	956,898	1,264		125,779	157,906
95	Potato coverers and hillers	2,938				
96	Rollers	22,188	12	15		231
97	Stalk cutters	15,146				8,822
98	All other	12,480	367			9,293
	Harvesting implements—					
99	Grain cradles	30,056				
100	Harvesters and binders and headers, grain	108,810	227			78,018
	Harvesters—					
101	Bean	665	35			
102	Corn	6,924				1,628
103	Other	3,161	2			36
104	Hay carriers	85,121	6			27,751
	Hayforks—					
105	Hand, dozens	345,297				
106	Horse	62,801	2,190			
107	Hay loaders	27,174	1			18,158
	Hayrakes—					
108	Hand, dozens	76,139				
109	Horse	236,297	371			120,926
110	Hay stackers	8,670	89			560
111	Hay tedders	35,745				1,019
112	Mowers	267,692				170,826
113	Mowers and reapers combined	5,693				16
114	Potato diggers	11,703				1,592
115	Potato hooks	139,940				
116	Reapers	60,996				35,856
117	Scythes	705,025		79,026		
118	Scythe snaths	699,636				
119	Sickles	247,716				
120	Stackers	845				
121	All other	6,659	1,449			237
	Seed separators—					
122	Bean separators	727	1			
123	Other separators	12,109				412
124	Clover hullers	351				
125	Corn huskers	1,327				583
	Cornshellers—					
126	Hand	47,189				10,653
127	Power	6,082				2,573
128	Fanning mills	22,994	1			300
	Thrashers—					
129	Horsepower	2,237	5			
130	Steampower	7,950	3			513
131	All other	1,182			47	950
	Miscellaneous—					
132	Bean pullers	1,587				221
133	Cane mills	2,996	30		1,071	
134	Carts	21,365	480			10,890
135	Check rowers	12,478				10,363
136	Corn cleaners	106				106
137	Corn hooks	44,628				
138	Corn knives	125,149		990		
139	Cotton gins	72			50	
140	Cotton presses	18				
141	Ensilage cutters	10,696				174
142	Engines and boilers	369				
143	Farm trucks	4,320	172			1,125
144	Gardening implements	494,034			1,350	15,767
145	Grubbing machines	1,043				165
146	Hand carts	9,359				2,739
147	Hay-cutters	29,283				
148	Hay presses	5,719	8		30	1,983
149	Hayracks	620				
150	Horsepowers	4,804	73			2,615
151	Lawn mowers	34,000				27,000
152	Pea hullers	1,706			412	
153	Portable sawmills	1,828	50			
154	Portable steam engines	1,190				
	Pumps—					
155	Hand	81,765				13,932
156	Horse	1,000				1,000
157	Steam	165				135
158	Road carts	373	12			
159	Shovels, spades, and scoops	868,899				
160	Singletrees	220,549	1,350		124,896	
161	Sirup evaporators	768			768	
162	Sorghum evaporators	2,447			874	
163	Straw stackers	8,034				715
164	Thrasher trucks	1,269				
165	Traction engines	6,165	29			397
166	Wagons	7,027	133			1,161
167	Wagon trucks	54	[illegible]			
168	Water trucks	2,077				18
169	Weeders	12,224	1,050	150		
170	Windmills	2,009				1,934

DETAILED SUMMARY, BY STATES: 1905—Continued.

Indiana.	Iowa.	Kansas.	Kentucky.	Maine.	Massachusetts.	Michigan.	Minnesota.	Mississippi.	
									81
638		800	5,000						82
205		4,000	1,000						83
3,600	1,300		5,000			424	800		84
	40				10	5,032			85
700	373			212		1,300		200	86
1,108	1,702	800	2,000		1,270	19,959	3,134	250	87
1,200	30,240			15	6,300	47,547			88
	134								89
320		75	1,000			263			90
10,540	146	225	5,000	56		9,025	47		91
									92
20,414	2,301	300	1,000		297	2,132	166		93
233,984	3,750	1,709	133,847	1,192	4,134	13,638	1,500	415	94
				700					95
					200	3,039			96
125		1,400	1,500		125	1,152			97
		425			118				98
15,000	168								99
							1,208		100
									101
	400	105				2			102
			1,075			1,300			103
	12,316						700		104
	35,660					62,004			105
	1,673								106
	4,612								107
	5,850			1,200	2,196	1,496			108
880	12,568	110			942	378	496		109
	3,556	43					5		110
					798	200			111
					1,565		930		112
									113
800	1,100	8			5	60			114
						26,616			115
									116
				253,791					117
169,000	42,960					129,692			118
				139,716					119
						822			120
				1,200					121
						300			122
290		50				3,730	7,457		123
191									124
133	183					185			125
	628		8,415		500				126
6					250	15	40		127
770					20	11,750	5,748		128
8				11	2	588	41		129
1,028	60					1,562	818		130
	35								131
						139			132
									133
	9,500				150		200		134
						1,209			135
									136
	7,332			25,296					137
	219	20		6,024		1,780			138
									139
									140
					42	40			141
							27		142
50					12				143
	15,396		5,000		24,800	14,363			144
	758								145
	1,093				150				146
				960	932				147
158	309	660				532			148
						400			149
					7	78	60		150
									151
									152
216					20	175			153
47						32			154
									155
									156
									157
						61			158
					61,566				159
	6,288		75,000		500	5,125			160
									161
									162
1,129	300					1,010	1,750		163
						98			164
740						1,727	571		165
			8		20	50			166
									167
504						584	50		168
				10		1,132			169
									170

TABLE 14.—AGRICULTURAL IMPLEMENTS—

		United States.	California.	Connecticut.	Georgia.	Illinois.
	Power:					
171	Number of establishments reporting	589	21	3	14	76
172	Total horsepower	106,623	605	590	1,557	46,648
	Owned—					
	Engines—					
	Steam—					
173	Number	698	9	8	16	181
174	Horsepower	75,018	184	270	916	31,038
	Gas and gasoline—					
175	Number	165	11		3	16
176	Horsepower	2,360	183		23	147
	Water wheels—					
177	Number	128	1	11		10
178	Horsepower	6,288	10	320		928
	Water motors—					
179	Number	4	3			
180	Horsepower	12	4			
	Electric motors—					
181	Number	690	2		21	415
182	Horsepower	16,885	22		618	11,714
183	Other power, horsepower	2,157				1,625
	Rented—					
	Electric motors—					
184	Number	182	15			41
185	Horsepower	3,828	197			1,163
186	Other kind, horsepower	75	5			33
187	Furnished to other establishments, horsepower	751		15		22

DETAILED SUMMARY, BY STATES: 1905—Continued.

Indiana.	Iowa.	Kansas.	Kentucky.	Maine.	Massachusetts.	Michigan.	Minnesota.	Mississippi.	
36	28	6	4	11	9	39	18	2	171
3,916	1,918	255	983	1,691	888	6,659	2,717	45	172
35	21	2	6	5	6	51	22	2	173
3,248	1,526	150	856	89	413	5,217	2,463	45	174
10	9	5		4	2	11	4		175
137	103	93		46	120	138	39		176
2	1			13	7	1			177
100	22			1,548	345	50			178
									179
									180
5	12		3			31	18		181
85	177		18			673	190		182
20									183
15	11	5	4	1	2	29	3		184
321	90	12	109	8	10	581	25		185
5									186
				685					187

TABLE 14.—AGRICULTURAL IMPLEMENTS—

		Missouri.	Nebraska.	New Hampshire.	New Jersey.	New York.	North Carolina.
1	Number of establishments	21	3	8	10	75	13
2	Capital, total	$1,299,575	$134,600	$62,100	$432,195	$23,436,429	$116,735
3	Land	$138,550		$3,250	$21,375	$1,001,905	$3,960
4	Buildings	$191,914	$15,000	$9,000	$75,967	$2,926,797	$23,600
5	Machinery, tools, and implements	$185,020	$60,300	$16,400	$54,767	$2,998,146	$27,550
6	Cash and sundries	$784,091	$59,300	$33,450	$280,086	$16,509,581	$61,625
7	Proprietors and firm members	18	2	11	9	66	13
	Salaried officials, clerks, etc.:						
8	Total number	89	11	3	37	934	8
9	Total salaries	$93,161	$6,000	$2,200	$40,005	$809,322	$9,250
	Officers of corporations—						
10	Number	13	2		8	53	6
11	Salaries	$29,100	$2,500		$13,050	$144,912	$7,600
	General superintendents, managers, clerks, etc.—						
12	Total number	76	9	3	29	881	2
13	Total salaries	$64,061	$3,500	$2,200	$26,955	$664,410	$1,650
	Men—						
14	Number	70	9	2	27	809	2
15	Salaries	$60,637	$3,500	$1,900	$26,445	$632,480	$1,650
	Women—						
16	Number	6		1	2	72	
17	Salaries	$3,424		$300	$510	$31,930	
	Wage-earners, including pieceworkers, and total wages:						
18	Greatest number employed at any one time during the year	845	69	71	326	8,516	160
19	Least number employed at any one time during the year	360	5	33	95	2,897	103
20	Average number	525	25	45	204	6,279	107
21	Total wages	$261,116	$15,025	$24,767	$89,787	$3,240,885	$30,883
	Men 16 years and over—						
22	Average number	521	25	45	204	6,251	103
23	Wages	$260,181	$15,025	$24,767	$89,787	$3,233,585	$30,328
	Women 16 years and over—						
24	Average number	1				19	
25	Wages	$300				$4,789	
	Children under 16 years—						
26	Average number	3				9	4
27	Wages	$635				$2,511	$555
	Average number of wage-earners, including pieceworkers, employed during each month:						
	Men 16 years and over—						
28	January	537	7	53	245	7,392	121
29	February	560	7	46	271	7,707	125
30	March	571	17	59	286	7,741	120
31	April	616	33	64	298	7,358	113
32	May	633	34	64	259	6,520	94
33	June	598	38	37	239	6,124	85
34	July	534	60	29	108	5,111	82
35	August	505	36	22	113	4,918	82
36	September	415	25	30	125	4,277	84
37	October	399	19	45	143	4,927	108
38	November	435	19	48	160	6,103	110
39	December	449	5	43	201	6,834	112
40	Miscellaneous expenses, total	$57,362	$6,574	$4,449	$53,082	$1,329,244	$5,108
41	Rent of works	$4,029	$435	$100	$400	$6,382	$140
42	Taxes	$3,564	$108	$422	$1,159	$62,600	$788
43	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$48,487	$6,031	$3,927	$50,323	$1,259,841	$3,755
44	Contract work	$1,282			$1,200	$421	$425
45	Materials used, aggregate cost	$452,056	$13,686	$13,568	$117,596	$5,678,339	$50,950
46	Principal materials, total cost	$361,299	$12,521	$10,425	$108,417	$4,127,262	$40,554
47	Purchased in raw state			$2,260		$5,109	
48	Purchased in partially manufactured form	$361,299	$12,521	$8,165	$108,417	$4,122,153	$40,554
49	Fuel	$15,190	$227	$2,120	$4,524	$227,673	$3,185
50	Rent of power and heat		$80			$5,770	
51	Mill supplies	$4,341	$38	$403	$970	$42,909	$420
52	All other materials	$58,041	$170	$620	$1,265	$1,214,238	$4,391
53	Freight	$13,185	$650		$2,420	$60,487	$2,400
54	Products, total value	$1,068,008	$46,000	$61,860	$391,926	$13,045,891	$126,865
55	Seeders and planters	$40,115	$36,000		$74,912	$1,800,182	$24,000
56	Implements of cultivation	$226,333	$7,500	$3,950	$187,243	$2,545,947	$46,070
57	Harvesting implements	$291,189		$47,600	$2,000	$5,841,389	$1,100
58	Seed separators	$45,389			$14,133	$461,814	
59	Miscellaneous	$362,821	$2,500		$85,401	$1,410,520	$8,495
60	All other products	$85,882		$9,500	$19,047	$889,596	$33,225
61	Amount received for repair work, etc	$16,279		$810	$9,190	$96,443	$13,975
	Kind and quantity of products, number of implements:						
	Seeders and planters—						
	Planters—						
62	Bean				45		
	Corn—						
63	Hand	750				2,4[illegible]5	
64	Horse					950	50
65	Cotton						4,750
66	Potato				934	250	
	Drills—						
67	Beet						
68	Corn	357				1,268	
69	Grain	125	1,000			11,948	
70	Grain sowers					118	
71	Lime spreaders					34	
72	Listers	1,060					
73	Manure spreaders				906	8,594	300
74	Seed sowers	700			2,691	1,375	
75	Tobacco transplanters					100	
76	All other						
	Implements of cultivation—						
	Cultivators—						
77	Bean						
78	Beet						
79	Small	1,804			11,759	23,746	6,000
80	Wheeled	7,607			3,275	3,721	455

[1] Includes establishments distributed as follows: Alabama, 2; Arkansas, 1; Colorado, 1; Maryland, 2; North Dakota, 1; Oregon, 1; South Dakota, 2; Utah, 1; Washington, 1; West Virginia, 1.

DETAILED SUMMARY, BY STATES: 1905—Continued.

Ohio.	Pennsylvania.	South Carolina.	Tennessee.	Texas.	Vermont.	Virginia.	Wisconsin.	All other states.[1]	
71	43	4	12	4	10	11	52	13	1
$24,301,986	$5,460,011	$13,351	$756,812	$147,271	$490,725	$329,990	$20,837,995	$515,100	2
$1,532,522	$416,306	$600	$49,750	$1,950	$39,000	$25,600	$997,476	$46,053	3
$3,660,252	$746,505	$2,465	$108,183	$12,800	$77,600	$48,906	$2,072,312	$88,421	4
$3,186,546	$803,640	$3,500	$126,574	$18,928	$102,889	$53,115	$2,129,587	$116,408	5
$15,922,666	$3,493,560	$6,786	$472,305	$113,593	$271,236	$202,369	$15,638,620	$264,218	6
39	54	5	9		8	18	42	13	7
918	220		34	8	23	21	1,017	19	8
$1,001,714	$226,832		$50,593	$9,400	$31,084	$20,220	$1,050,112	$22,330	9
103	31		7	3	3	1	44	6	10
$230,794	$54,006		$17,700	$4,600	$10,000	$3,000	$98,613	$6,140	11
815	189		27	5	20	20	973	13	12
$770,920	$172,826		$32,893	$4,800	$21,084	$17,220	$951,499	$16,190	13
686	168		21	5	20	16	915	13	14
$713,156	$164,674		$29,945	$4,800	$21,084	$14,960	$920,252	$16,190	15
129	21		6			4	58		16
$57,764	$8,152		$2,948			$2,260	$31,247		17
7,612	2,674	17	846	72	288	445	4,897	226	18
3,280	2,141	9	466	43	207	234	1,909	129	19
5,659	2,394	12	613	47	247	314	3,569	173	20
$2,909,540	$1,103,441	$4,065	$216,306	$23,943	$113,524	$115,727	$1,885,775	$93,653	21
5,619	2,376	12	593	47	238	312	3,530	171	22
$2,894,691	$1,099,719	$4,065	$213,231	$23,943	$111,589	$115,277	$1,874,628	$93,278	23
39	1		3		7		20		24
$14,673	$235		$825		$1,635		$5,540		25
1	17		17		2	2	19	2	26
$176	$3,487		$2,250		$300	$450	$5,607	$375	27
6,531	2,396	12	746	67	261	310	3,516	188	28
6,888	2,435	12	643	50	270	319	4,013	177	29
6,964	2,472	12	641	51	255	330	4,263	180	30
6,740	2,531	10	609	34	254	338	4,027	187	31
6,155	2,509	8	528	37	248	323	3,573	196	32
5,584	2,447	11	496	34	237	321	3,194	184	33
4,720	2,314	13	478	37	224	311	3,328	141	34
4,048	2,246	12	510	35	204	300	3,503	137	35
4,129	2,248	12	550	48	224	286	3,421	154	36
4,491	2,263	14	638	53	218	284	3,000	166	37
5,312	2,296	14	626	56	221	306	3,052	172	38
5,866	2,355	14	651	62	240	316	3,470	170	39
$1,650,747	$566,272	$6,794	$65,203	$36,402	$41,559	$20,640	$2,278,736	$55,060	40
$1,977	$685	$125		$750	$50	$6,340	$8,497	$1,500	41
$114,757	$10,904	$54	$4,954	$568	$2,143	$1,823	$64,561	$2,814	42
$1,504,925	$541,183	$5,365	$59,299	$19,584	$39,366	$12,477	$2,205,328	$50,246	43
$29,088	$13,500	$1,250	$950	$15,400			$350	$500	44
$5,692,218	$2,074,973	$12,635	$314,279	$74,233	$182,403	$182,433	$3,519,856	$151,984	45
$4,639,103	$1,615,192	$11,745	$234,683	$65,935	$156,879	$139,833	$2,662,268	$135,420	46
$200	$244				$9,075	$645	$555		47
$4,638,903	$1,614,948	$11,745	$234,683	$65,935	$147,804	$139,188	$2,661,713	$135,420	48
$169,408	$65,457	$180	$22,461	$1,960	$11,802	$7,898	$143,062	$5,737	49
$130	$620			$276		$600	$623	$1,300	50
$63,386	$11,803	$60	$774	$299	$2,985	$680	$37,877	$817	51
$729,922	$367,379	$650	$55,361	$2,848	$10,737	$31,816	$632,612	$7,945	52
$90,269	$14,522		$1,000	$2,915		$1,605	$43,414	$765	53
$12,891,197	$5,016,679	$34,932	$768,895	$187,134	$441,671	$404,281	$10,076,760	$398,192	54
$2,016,919	$186,449	$3,215	$12,000			$32,225	$911,438	$75	55
$3,031,384	$987,619	$192	$545,076	$156,074	$40,829	$189,287	$2,219,657	$138,300	56
$3,193,853	$393,917		$5,806	$700	$263,270	$1,465	$1,541,020	$34,895	57
$501,482	$489,956		$40,000		$26,569	$16,800	$1,035,686	$45,900	58
$2,430,577	$2,229,802	$20,000	$87,685	$3,800	$96,602	$3,295	$2,742,225	$16,890	59
$1,193,560	$658,270	$10,725	$70,293	$26,450	$11,035	$152,279	$1,547,331	$113,775	60
$523,422	$70,666	$800	$8,035	$110	$3,366	$8,930	$79,401	$48,357	61
									62
25,578							633		63
6,054	3,022					575	4,033		64
3,634	575	260	6,000			1,375	1,500		65
664							6,291		66
35								1	67
7,258			200				150		68
23,636	1,075						7,208		69
2,338							6,407		70
123									71
244							2,525		72
2,442	1,611						75		73
68	11,700	600					350		74
542							500		75
						1,150			76
7									77
225							500		78
65,157	62,116					5,900	3,385	5,240	79
44,187	9,023						29,656		80

TABLE 14.—AGRICULTURAL IMPLEMENTS—

		Missouri.	Nebraska.	New Hampshire.	New Jersey.	New York.	North Carolina.
	Kind and quantity of products, number of implements—Con.						
	Implements of cultivation—Continued.						
81	Celery hillers					720	
82	Cotton scrapers						
83	Cotton sweeps						
84	Equalizers		1,500			2,447	
	Harrows—						
85	Disk	199				22,866	
86	Spring-tooth					65,594	
87	Spike-tooth	256			7,622	38,357	90
88	Hoes, dozens			250		67,051	
89	Markers and furrowers				209	476	
	Plows—						
90	Disk					422	
91	Shovel					8,884	10
92	Steam						
93	Sulky or wheel	144				2,951	
94	Walking	482		295	65	78,545	4,000
95	Potato coverers and hillers					1,338	
96	Rollers				8	2,014	
97	Stalk cutters	108					80
98	All other						
	Harvesting implements—						
99	Grain cradles					700	300
100	Harvesters and binders and headers, grain					19,161	
	Harvesters—						
101	Bean					550	
102	Corn					1,881	
103	Other					700	
104	Hay carriers				50	740	
	Hayforks—						
105	Hand, dozens					60,800	
106	Horse				200	750	
107	Hay loaders						
	Hayrakes—						
108	Hand, dozens	525		7,550		14,157	
109	Horse	12,000				39,844	
110	Hay stackers	3,691					
111	Hay tedders					18,063	
112	Mowers					57,919	
113	Mowers and reapers combined					5,677	
114	Potato diggers				24	526	
115	Potato hooks					2,200	
116	Reapers					21,457	
117	Scythes			72,004		240,204	
118	Scythe snaths						
119	Sickles						
120	Stackers						
121	All other					1,373	
	Seed separators—						
122	Bean separators					221	
123	Other separators	55					
124	Clover hullers						
125	Corn huskers					4	
	Cornshellers—						
126	Hand	4,000				891	
127	Power	40				92	
128	Fanning mills					125	
	Thrashers—						
129	Horsepower	9			14	89	
130	Steampower	9			23	611	
131	All other						
	Miscellaneous—						
132	Bean pullers					1,207	
133	Cane mills						
134	Carts						145
135	Check rowers						
136	Corn cleaners						
137	Corn hooks						
138	Corn knives					67,716	
139	Cotton gins	14					
140	Cotton presses	13					
141	Ensilage cutters					300	
142	Engines and boilers				30	32	
143	Farm trucks					4	540
144	Gardening implements	75			3,220	120,000	
145	Grubbing machines						
146	Hand carts	500				1,384	
147	Hay-cutters	700				23,232	
148	Hay presses	1,550				325	
149	Hayracks					220	
150	Horsepowers	110			6	8	
151	Lawn mowers						
152	Pea hullers					85	
153	Portable sawmills	20			17	21	
154	Portable steam engines				6	106	
	Pumps—						
155	Hand						
156	Horse						
157	Steam						
158	Road carts					30	
159	Shovels, spades, and scoops						
160	Singletrees						
161	Sirup evaporators						
162	Sorghum evaporators						
163	Straw stackers					60	
164	Thrasher trucks	30				479	
165	Traction engines					592	
166	Wagons	11				362	
167	Wagon trucks						87
168	Water trucks						
169	Weeders		500		462	174	
170	Windmills	75				1,803	

DETAILED SUMMARY, BY STATES: 1905—Continued.

Ohio.	Pennsylvania.	South Carolina.	Tennessee.	Texas.	Vermont.	Virginia.	Wisconsin.	All other states.	
200	130								81
200			8,000						82
									83
231									84
19,245						100	8,242		85
12,486	3,603		140				600		86
40,749	950		552			5,150	20,413	725	87
76,994	18,000		41,567		3,250				88
	160							500	89
7,356	15		6,074	770			1,943	40	90
66,749	875		4,811			1,850		3,000	91
1,501	15						40		92
213	350						22,720	150	93
49,792	47,242		28,447	18,421	2,080	29,398	18,412	601	94
150					500		250		95
10,863	4,139				90	1,000	562	15	96
172	30	12				800	370	500	97
1,077				1,200					98
600	7,638					650		5,000	99
4,099							6,097		100
80									101
1,285	2						1,497	25	102
48									103
32,500							11,058		104
98,741	47,203		797		40,092				105
55,000							2,988		106
4,403									107
27,833	15,332								108
36,262				30			11,140	350	109
501								225	110
15,215	400						50		111
19,382							17,070		112
									113
3,353	2,950						1,285		114
45,684	36,000		11,028		18,412				115
2,186							1,497		116
					60,000				117
97,260	86,400				174,324				118
					108,000				119
								23	120
2,300								100	121
	205								122
68	22						25		123
100	60								124
							239		125
4,246	12,991		3,200			1,450	25		126
451	2,265					350			127
	250					5	4,025		128
4	850				203		393	25	129
972	713						1,582	56	130
100	50								131
20									132
			1,825			70			133
									134
906									135
									136
					12,000				137
					48,000		400		138
						8			139
						5			140
9,539	250				20		331		141
	280								142
1,700	177						540		143
116,955	3,048		29,280		144,780				144
120									145
3,023	15					50	405		146
	2,608					325	526		147
139				25					148
									149
198	560				159		899	31	150
7,000									151
	205	1,000	4						152
140	805				127		225	12	153
196	703						100		154
67,800	33								155
									156
									157
							300		158
	804,045		3,288						159
5,030	2,000					360			160
									161
			1,513						162
232	379						2,007	33	163
316	149				26		58		164
773	357						1,209		165
3,546	3						2,008		166
								50	167
266	6						13		168
229	5,929				331		890	200	169
									170

TABLE 14.—AGRICULTURAL IMPLEMENTS—

		Missouri.	Nebraska.	New Hampshire.	New Jersey.	New York.	North Carolina.
	Power:						
171	Number of establishments reporting	21	3	7	9	73	11
172	Total horsepower	856	32	365	423	13,342	206
	Owned—						
	Engines—						
	Steam—						
173	Number	20	1	1	7	80	9
174	Horsepower	790	25	40	123	8,893	177
	Gas and gasoline—						
175	Number	7	2		3	9	1
176	Horsepower	66	7		130	114	14
	Water wheels—						
177	Number			8	5	43	1
178	Horsepower			325	150	1,861	15
	Water motors—						
179	Number						
180	Horsepower						
	Electric motors—						
181	Number				5	65	
182	Horsepower				20	1,323	
183	Other power, horsepower					512	
	Rented—						
	Electric motors—						
184	Number					13	
185	Horsepower					629	
186	Other kind, horsepower					10	
187	Furnished to other establishments, horsepower						

DETAILED SUMMARY, BY STATES: 1905—Continued.

Ohio.	Pennsylvania.	South Carolina.	Tennessee.	Texas.	Vermont.	Virginia.	Wisconsin.	All other states.	
70	33	3	11	3	9	9	48	12	171
9,152	3,240	34	704	50	666	383	8,101	597	172
83	40	2	13	2	4	8	58	6	173
7,607	2,725	24	649	40	225	351	6,683	251	174
27	6	1	5	...	4	...	20	5	175
598	53	10	43	...	66	...	211	19	176
3	5	...	...	...	13	1	2	1	177
125	46	...	...	...	367	12	32	32	178
...	...	...	...	...	1	...	...	...	179
...	...	...	...	...	8	...	...	...	180
56	1	...	2	...	...	...	49	5	181
798	10	...	12	...	...	...	1,135	90	182
...	...	...	...	...	...	...	...	...	183
1	28	...	...	1	...	3	3	7	184
4	406	...	...	10	...	20	38	205	185
20	...	...	...	...	...	...	2	...	186
4	25	...	...	...	...	...	...	...	187

ELECTRICAL MACHINERY, APPARATUS, AND SUPPLIES

ELECTRICAL MACHINERY, APPARATUS, AND SUPPLIES.

By Thomas Commerford Martin, Expert Special Agent.

The first complete record made by any government of the manufacture of electrical apparatus and supplies was that included in the Twelfth Census of the United States. Prior to this, general and miscellaneous figures had been secured, which, however, had reference rather to specific industries and developments than to the electrical arts as a whole.

At the censuses of 1880 and 1890 general statistics were obtained as to the number of electrical manufacturing establishments, their gross products, capital invested, number of wage-earners, wages paid, cost of materials, and a few other items. But Census Bulletin No. 245, of August 25, 1902, was the first to summarize or to analyze the entire product of American electrical factories and to discuss the conditions of electrical manufacturing as a great and growing field of American inventiveness, industry, and investment. That bulletin was followed in due sequence by a series of reports on the generation and utilization of electric current employing the machinery and apparatus furnished by the electrical manufacturing industries. One of these reports dealt exhaustively with street and electric railways; another with central electric light and power stations; and a third with telephones and telegraphs, including municipal fire alarm and police patrol systems. In fact, with the issuance of the Report on Telephones and Telegraphs, January 23, 1906, the Bureau of the Census closed the first and only census ever taken of the group of arts and industries dealing with the employment of the electric current for transportation, illumination, distribution of power, the long distance transmission of speech, and the instantaneous communication of messages and intelligence. The present bulletin, dealing with figures of electrical manufacturing for the census of 1905, begins in reality the new series of reports on these allied industries, as hereafter the census of street railways, lighting plants, and telephone and telegraph systems will be taken in five-year instead of ten-year periods. The rapidity of growth in these fields is probably unsurpassed in any other branch of human activity, and the more frequent record of these statistics adds greatly, therefore, to their value and utility.

In the report on electrical industries for 1900 a large quantity of products for which an electrical use could be predicated was excluded; these figures are, however, included within the scope of other Census inquiries. Among the products excluded then and now, were poles, whether of wood, iron, or steel; a large amount of glass and porcelain ware made only for electrical purposes; bare iron and copper wire; and the whole group of electro-chemical and electro-metallurgical products.

The extent of items of this character excluded may be gathered from the fact that the electrical conduits reported by the pottery, terra cotta, and fire clay industry for 1905 reached a value of $602,682 in the class of terra cotta, fire and other clay products. The products reported as of the nature of porcelain electrical supplies reached a value of $1,500,283, as compared with a total of only $470,355 at the census of 1900. The product of electrical conduits in 1900 was reported as valued at $685,273, so that while the conduit showed a slight decrease in the period, the porcelain electrical supplies showed apparently an enormous increase. It would not be safe, however, to take these figures on their face, and the great gain in porcelain may be attributed to the inclusion of goods or supplies which might more strictly have been included within the statistics of electrical industries in 1900. Some of the largest electrical manufacturers have purchased or equipped separate porcelain factories, and one of them has an extensive porcelain department carried on in close connection with its other shops of an entirely

different nature. As will be seen, however, these two items for 1905 make a total of $2,102,965, not included in the electrical returns, but obviously bearing a very intimate relationship to that generic class of apparatus and supplies. It is to be observed that in Table 17, relating to electrical conduits, almost the entire product reported deals with interior conduits, which are of a metallic or textile nature in general; only short sections, such as those for running through floors or penetrating exterior walls, being of porcelain. Apparently the porcelain sections are not here included, as they are not regarded as conduits in the electrical trade, but are usually spoken of as "tubes." Undoubtedly a large quantity of this material is therefore embraced in the porcelain item just referred to, while in like manner none of the terra cotta and other clay conduits has been brought to account in the small amount of underground conduits enumerated in Table 17.

Table 1 presents the comparative figures of electrical machinery, apparatus, and supplies for 1880, 1890, 1900, and 1905.

Table 1.—COMPARATIVE SUMMARY, WITH PER CENT OF INCREASE: 1880 TO 1905.

	CENSUS.				PER CENT OF INCREASE.		
	1905	1900 [1]	1890	1880	1900 to 1905	1890 to 1900	1880 to 1890
Number of establishments	784	581	189	[2] 76	34.9	207.4	148.7
Capital	$174,066,026	$83,659,924	$18,997,337	$1,509,758	108.1	340.4	1,158.3
Salaried officials, clerks, etc., number	10,619	5,067	[3] 683	(4)	109.6	641.9	....
Salaries	$11,090,885	$4,631,723	[3] $849,138	(4)	139.5	445.5	....
Wage-earners, average number	60,466	42,013	8,802	1,271	43.9	377.3	592.5
Total wages	$31,841,521	$20,579,194	$4,517,050	$683,164	54.7	355.6	561.2
Men 16 years and over	48,976	34,462	7,289	1,132	42.1	372.8	540.9
Wages	$28,316,772	$18,513,653	$4,082,847	(4)	53.0	353.4	....
Women 16 years and over	10,902	6,956	1,469	72	56.7	373.5	1,940.3
Wages	$3,410,081	$1,943,220	$426,660	(4)	75.5	355.4	....
Children under 16 years	588	595	44	67	[5] 1.2	1,252.3	[5] 34.3
Wages	$114,668	$122,321	$7,543	(4)	[5] 6.3	1,521.6	....
Miscellaneous expenses	$17,948,708	$6,804,633	$1,154,462	(6)	163.8	489.4	....
Cost of materials used	$66,836,926	$49,458,272	$8,819,498	$1,116,470	35.1	460.8	689.9
Value of products, including amount received for custom work and repairing	[7] $140,809,369	[8] $92,434,435	$19,114,714	$2,655,036	52.3	383.6	619.9

[1] The totals for 1900 do not agree with those published at the Twelfth Census because of a reclassification.
[2] Includes 36 establishments reported as "electrical apparatus and supplies," and 40 reported as "telegraph and telephone apparatus."
[3] Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905, but not included in this table.
[4] Not reported separately.
[5] Decrease.
[6] Not reported.
[7] Exclusive of electrical machinery, apparatus, and supplies, valued at $18,742,033, made by establishments engaged primarily in the manufacture of other products.
[8] Exclusive of electrical machinery, apparatus, and supplies, valued at $13,397,430, made by establishments engaged primarily in the manufacture of other products.

In spite of the general tendency toward the consolidation of manufacturing establishments there was a gain in number of 34.9 per cent between 1900 and 1905, while the capital increased 108.1 per cent. Other large increases will be noted in the number of salaried officials and wage-earners, and particularly in the amounts paid out to employees. Throughout the last five years labor has been actively and remuneratively employed in all the electrical industries and no single strike of any serious magnitude has been recorded.

The increase in the total value of products, 1900 to 1905, was 52.3 per cent, which is a good indication of the capacity of the field at large for consumption, although various factors have come in to establish wide differences in the increase in the respective departments of the electrical business. In many instances, moreover, while the general trend of prices has been upward the cost of electrical apparatus to the consumer has been less, owing to large production and greater refinements in the processes. This has been affected, however, by the higher cost of such raw material as copper, the price of which has risen steadily throughout the entire term.

The growth of the industry since 1880, as shown by the census figures, is a remarkable illustration of the ingenuity of inventors, and the enterprise of manufacturers, in creating and supplying, during the past twenty-five years, an ever-enlarging demand for electrical machinery, apparatus, and supplies. The increase in number of establishments has been over ninefold, and in average number of wage-earners more than forty-six fold. The wages paid, amounting in 1880 to a little less than $700,000, reached, at the census of 1905, a total of nearly thirty-two millions, the gain being greater than forty-five fold. In value of products the increase has been over fifty-two fold.

Table 2 compares the general statistics, by states, for 1900 and 1905.

TABLE 2.—COMPARATIVE SUMMARY, BY STATES: 1905 AND 1900.

STATE.	Census.	Number of establishments.	Capital.	Salaried officials, clerks, etc.: Number.	Salaried officials, clerks, etc.: Salaries.	Wage-earners and wages: Total: Average number.	Wage-earners and wages: Total: Wages.	Men 16 years and over: Average number.	Men 16 years and over: Wages.	Women 16 years and over: Average number.	Women 16 years and over: Wages.	Children under 16 years: Average number.	Children under 16 years: Wages.	Miscellaneous expenses.	Cost of materials used.	Value of products, including amount received for custom work and repairing.
United States	1905	784	$174,066,026	10,619	$11,090,885	60,466	$31,841,521	48,976	$28,316,772	10,902	$3,410,081	588	$114,668	$17,948,708	$66,836,926	[1] $140,809,369
	[2] 1900	581	83,659,924	5,067	4.631,723	42,013	20,579,194	34,462	18,513,653	6,956	1,943,220	595	122,321	6,804,633	49,458,272	[3] 92,434,435
California	1905	24	716,440	112	112,836	403	244,123	364	232,164	32	10,483	7	1,476	74,523	434,241	1,004,284
	1900	11	181,474	29	28,638	238	129,906	228	127,826			10	2,080	11,771	369,135	555,735
Colorado	1905	7	141,800	14	18,450	89	54,574	48	37,074	41	17,500			10,900	65,480	178,759
	1900	4	77,000	6	6,000	84	41,720	56	30,120	27	11,200	1	400	8,027	51,608	121,000
Connecticut	1905	32	4,183,535	225	278,011	1,707	724,426	1,197	593,872	403	112,210	107	18,344	431,226	2,754,122	4,939,831
	1900	17	2,513,812	142	170,490	961	405,604	690	336,112	270	69,307	1	185	222,400	1,973,715	3,167,842
Illinois	1905	104	21,644,783	1,631	1,406,868	6,131	3,203,435	4,941	2,780,370	1,186	422,187	4	878	1,969,790	7,649,446	16,700,027
	1900	82	11,641,177	1,142	637,933	6,048	2,818,274	4,699	2,440,344	1,246	356,927	103	21,003	1,565,404	4,675,961	12,169,425
Indiana	1905	34	3,174,505	384	382,421	1,416	663,834	1,232	615,925	184	47,909			459,061	1,066,634	2,857,174
	1900	24	1,453,356	134	133,693	881	340,355	715	304,922	166	35,433			89,172	784,393	1,586,229
Kentucky	1905	3	203,701	9	8,348	73	34,518	60	31,273	13	3,245			14,033	84,406	169,788
	1900	4	76,077	7	6,379	56	24,396	37	21,801	18	2,461	1	134	11,526	66,285	117,680
Maryland	1905	6	191,315	23	26,248	161	65,813	139	62,198	14	2,600	8	1,015	20,679	92,600	224,859
	1900	6	236,710	26	26,925	155	54,303	137	50,967	13	2,736	5	600	28,156	112,464	266,811
Massachusetts	1905	72	12,735,427	871	962,650	8,798	5,003,190	7,107	4,437,918	1,499	521,185	192	44,087	1,448,091	7,324,167	15,882,216
	1900	54	8,259,612	565	556,703	5,202	2,714,449	4,256	2,445,100	843	244,221	103	25,128	454,008	5,250,293	10,490,361
Michigan	1905	14	413,732	60	58,588	529	176,817	372	148,852	143	25,366	14	2,599	97,031	294,374	702,102
	1900	12	547,319	29	28,962	184	86,188	170	81,269	11	4,513	3	406	38,314	182,452	438,144
Minnesota	1905	15	389,211	32	35,960	170	103,015	168	102,040	2	975			30,146	186,561	423,933
	1900	12	79,935	13	7,976	86	45,340	86	45,340					9,585	121,782	228,076
Missouri	1905	20	1,644,031	183	193,244	795	411,804	546	327,999	239	81,565	10	2,240	227,048	606,424	1,740,583
	1900	17	981,975	59	68,650	533	186,216	405	156,646	111	26,245	17	3,325	144,966	355,475	910,602
New Hampshire	1905	5	162,486	14	12,359	88	32,224	44	22,235	39	9,989			14,496	88,388	149,871
	1900	5	183,233	11	7,056	94	32,956	53	22,331	41	10,625			3,704	81,614	181,793
New Jersey	1905	42	18,457,821	1,012	1,002,693	6,268	2,894,139	3,833	2,203,102	2,353	676,246	82	14,791	1,581,525	6,872,638	13,803,476
	1900	36	7,909,120	623	666,622	3,916	1,903,183	2,817	1,575,016	1,016	311,154	83	17,013	785,454	3,538,740	7,532,700
New York	1905	175	30,643,167	1,668	1,730,441	16,301	9,286,912	14,405	8,700,862	1,854	578,405	42	7,645	3,263,950	17,846,213	35,348,276
	1900	134	17,697,352	1,113	904,201	10,370	5,666,702	9,266	5,341,834	1,023	309,044	81	15,824	893,038	12,538,790	22,695,024
Ohio	1905	92	10,408,184	1,023	1,079,006	5,114	2,268,497	3,747	1,874,381	1,352	391,776	15	2,340	1,685,514	4,699,140	11,019,235
	1900	64	7,036,103	394	399,202	3,773	1,502,270	2,956	1,315,376	794	181,569	23	5,325	568,201	3,338,978	6,504,847
Pennsylvania	1905	80	58,393,011	2,746	3,089,535	9,404	5,299,668	8,252	4,909,121	1,069	375,709	83	14,838	5,580,353	11,365,212	26,257,569
	1900	63	20,967,587	646	836,960	7,817	4,002,737	6,600	3,677,780	1,054	294,236	163	30,721	1,647,426	11,372,739	19,112,665
Rhode Island	1905	11	3,608,034	119	153,096	1,409	557,065	1,002	442,441	398	112,524	9	2,100	201,343	4,017,178	5,435,474
	1900	13	2,652,135	50	64,524	864	328,691	586	254,318	278	74,373			257,774	4,134,980	5,113,292
Wisconsin	1905	23	6,329,351	396	450,644	1,204	672,812	1,140	655,891	59	15,844	5	1,077	758,306	1,020,359	3,194,132
	1900	7	981,553	56	63,744	527	221,501	489	213,701	38	7,800			48,245	358,976	923,587
All other states	[4] 1905	25	625,492	97	89,487	411	144,655	379	139,054	22	4,363	10	1,238	80,693	369,343	777,780
	[5] 1900	16	184,394	22	17,065	224	74,403	216	72,850	7	1,376	1	177	17,462	159,892	318,622

[1] Exclusive of electrical machinery, apparatus, and supplies, valued at $18,742,033, made by establishments engaged primarily in the manufacture of other products. This value was distributed as follows: California, $81,600; Connecticut, $591,094; Illinois, $1,056,263; Indiana, $252,208; Maryland, $400; Massachusetts, $14,900; Michigan, $217,131; Missouri, $205,745; New Hampshire, $28,185; New Jersey, $5,130,814; New York, $5,494,909; Ohio, $1,557,660; Pennsylvania, $2,683,549; Rhode Island, $339,666; Wisconsin, $599,000; and "all other states," $488,909.

[2] The totals for 1900 do not agree with those published at the Twelfth Census because of a reclassification.

[3] Exclusive of electrical machinery, apparatus, and supplies, valued at $13,397,430, made by establishments engaged primarily in the manufacture of other products.

[4] Includes establishments distributed as follows: Delaware, 1; District of Columbia, 2; Georgia, 2; Iowa, 2; Louisiana, 2; Maine, 2; Nebraska, 2; Oregon, 2; South Carolina, 1; Tennessee, 2; Texas, 3; Virginia, 2; Washington, 1; West Virginia, 1.

[5] Includes establishments distributed as follows: Delaware, 1; Georgia, 1; Iowa, 2; Louisiana, 2; Maine, 2; Nebraska, 3; North Carolina, 2; South Carolina, 1; Tennessee, 1; Texas, 1.

The distribution of electrical manufacturing throughout the states has remained the same in all essential respects at the two censuses. New York, Illinois, Ohio, Pennsylvania, and Massachusetts reported at the census of 1905, 523 out of 784 establishments making electrical apparatus, or two-thirds (66.7 per cent). If to these be added the 32 establishments in Connecticut, the 34 in Indiana, and the 42 in New Jersey, it will be seen that 631 out of 784 establishments are concentrated in these eight states. Incandescent lamps are made all over the country, but the largest output is from a plant in New Jersey, which also makes many of the best electrical instruments (although in this respect Massachusetts is also well to the front). The manufacture of insulated wires and cables has had its center on the Atlantic seaboard, particularly in the states of Massachusetts, Connecticut, Rhode Island, New York, and New Jersey, but such material was also produced in large quantities farther west. While the production of telephonic apparatus has always been large in Illinois, this industry has undergone development in several other of the Western

states, due to the "independent" telephone movement; and in the Middle states one or two of the largest plants being in New York. A few of the plants enumerated were brought into being by their proximity to lumber regions, affording a supply of insulating pins, cross-arms, etc.

The gross values of the output at the census of 1905, as shown by Table 2, were in close proportion to the number of establishments, but the states do not come in quite the same order. New York led, followed by Pennsylvania, Illinois, Massachusetts, New Jersey, and Ohio, in the order given. If the amounts for these states be totaled, it will be seen that the great bulk of all products, or over five-sixths of the whole (84.5 per cent) came from these 6 states.

The great increase in the amount of capital invested in the period has been referred to. In 1900 the $83,659,924 of capital invested had, so to speak, reproduced itself during the year with a margin of almost $9,000,000, the value of the products being $92,434,435. In the year 1905, however, the capitalization of $174,066,026 returned was associated with a production valued at $140,809,369—an indication of an undue increase in the capitalization. According to Table 2 this increase was distributed uniformly throughout the country, but was greatest by far in the state of Pennsylvania, where the increase was from $20,967,587 to no less a sum than $58,393,011; in other words, there was an increase of capital in that state of 178.5 per cent, although the value of products increased only from $19,112,665 to $26,257,569. In New York state the capitalization increased from $17,697,352 to $30,643,167, but the value of the products rose from $22,695,024 to $35,348,276. Another notably large increase in capitalization was that in Illinois, where it rose from $11,641,177 to $21,644,783, while the products increased only from $12,169,425 to $16,700,027. In New Jersey the capitalization increased 133.4 per cent, namely, from $7,909,120 to $18,457,821, but the value of the products exhibited a similarly large increase, namely, from $7,532,700 to $13,803,476. Ohio exhibited a more normal ratio of increase in capital and product, as the capital increased from $7,036,103 to $10,408,184, while the products rose from $6,504,847 to $11,019,235. In Massachusetts also the ratio ran about the same, the capitalization increasing from $8,259,612 to $12,735,427, while the value of the products rose from $10,490,361 to $15,882,216. These are the larger figures, while at the other end of the scale, as shown by Table 2, were several states in which the electrical product as well as the invested capital was insignificant. Fourteen states in 1905, with a total of 25 manufacturing establishments, reported a capital of only $625,492 and products valued at $777,780. There was, however, a noteworthy increase in Minnesota, where the capitalization increased 386.9 per cent in the period, namely, from $79,935 to $389,211, with a product valued at $423,933.

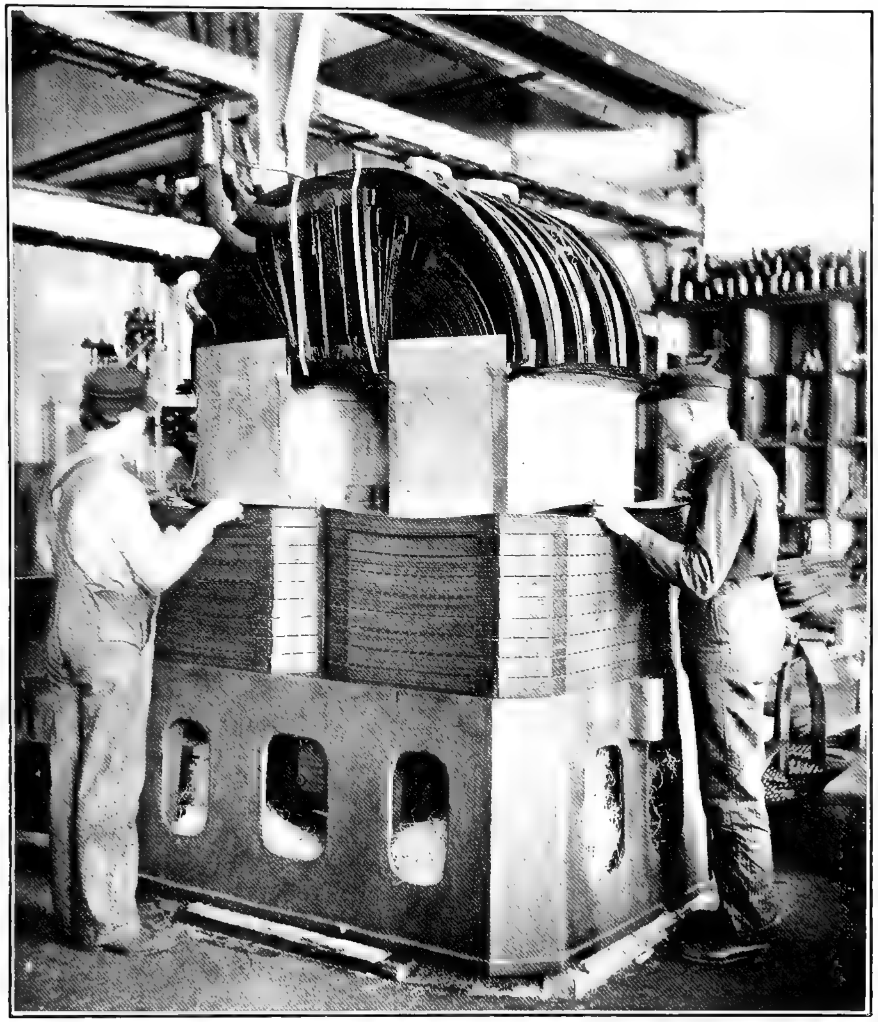
PRODUCTS IN DETAIL.

Practically little of the vast production of electrical machinery, apparatus, and supplies goes across the counter directly into the hands of individual consumers. The great bulk of it is purchased and consumed by public service corporations. There are relatively few electrical stores or jobbing houses for retail trade, and even these find their patronage mostly among the electrical contractors. There are no large department stores or other agencies of retail trade through which this vast aggregate of electrical apparatus and supplies can be distributed, but, on the other hand, there were in 1902, 987 operating and lessor street railway companies which constituted the only market for street railway apparatus, and 3,620 private or municipal central station lighting plants, which with some 50,000 isolated plants constituted almost the entire market for electric lamps of all kinds. The third large field of public service electrical consumption was afforded by 25 large telegraph systems and 4,151 telephone systems, in which was used an overwhelming proportion of the telegraphic and telephonic apparatus. Supplementing these intelligence systems there were also in 1902, 764 municipal electric fire alarm systems and 148 electric police patrol systems. It will be readily understood, therefore, that after these large channels of consumption had been filled very little of the apparatus or material was left for the retail purchaser whose average wants, indeed, are limited to an occasional incandescent lamp, a fan motor, a push button, or a few feet of wire. All of these departments, except perhaps that of telegraphy, have made gigantic strides in the last five years, and to their prosperity, therefore, must be attributed the general well-being of electrical manufacturing as exhibited in Tables 1 and 2.

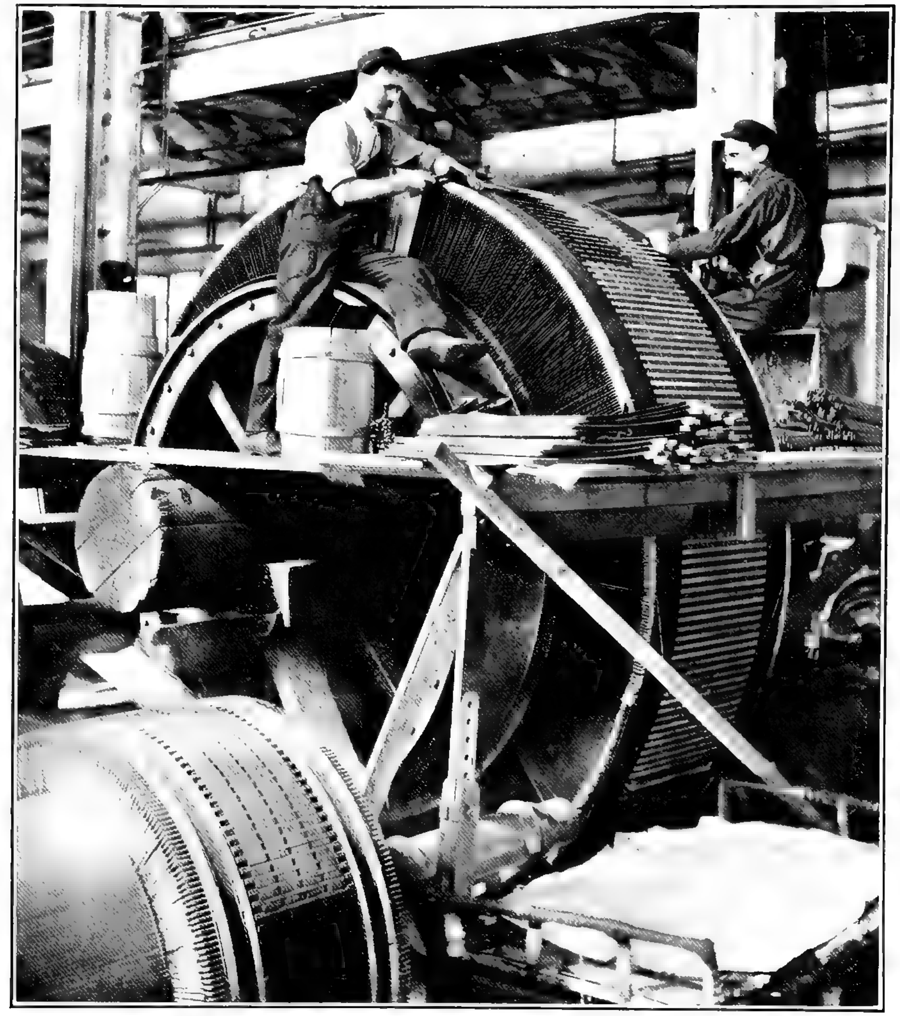
In addition to the electrical products manufactured by the 784 establishments in 1905 and the 581 in 1900, shown in Tables 1 and 2, a large quantity of electrical machinery and apparatus was made by establishments engaged primarily in the manufacture of other products. The value of such products as reported at the censuses of 1900 and 1905 was $13,397,430 and $18,742,033, respectively. The distribution by states of the total for 1905 is shown in a footnote to Tables 2 and 27. The magnitude of this electrical manufacturing carried on in establishments in which it is not the chief product or sole business, is illustrated by the fact that the total of $18,742,033 at the census of 1905 was produced by no fewer than 128 establishments located in 25 states, giving an average value per establishment of $146,422.

The above partial products for both 1905 and 1900, while not included in Tables 1, 2, and 27 of this report, are included in their respective groups in the detailed tables, which present the products by kind, quantity, and value.

Tables 3 to 26, inclusive, give in detail the statistics



CONSTRUCTING A LARGE ALTERNATING CURRENT TRANSFORMER.



BUILDING UP THE ARMATURE OF A LARGE ELECTRIC GENERATOR.

for the different varieties of electrical apparatus and supplies manufactured. Comparative figures for the total for the United States are presented for the comparable products that were reported separately at the censuses of 1900 and 1905. In a number of the states there were only one or two establishments engaged in the manufacture of some of these different classes of products, and to present the statistics for them would result in disclosing the operations of individual establishments. Therefore the totals for 1905 are given by states only in cases where such a presentation does not result in giving figures for less than three establishments engaged in the manufacture of any distinct class of products.

Dynamos.—The statistics with regard to the production of dynamos are presented in Table 3.

Table 3.—DYNAMOS—NUMBER, HORSEPOWER, AND VALUE: 1905 AND 1900.

STATE.	TOTAL.			DIRECT CURRENT.			ALTERNATING CURRENT.		
	Number.	Horsepower.	Value.	Number.	Horsepower.	Value.	Number.	Horsepower.	Value.
United States, 1905	15,080	1,328,243	$11,084,234	13,756	853,800	$6,973,130	1,324	474,443	$4,111,104
1900	10,527	770,832	10,472,576	9,182	428,601	6,297,925	1,345	342,231	4,174,651
States, 1905:									
Illinois	2,301	384,015	881,625	2,301	384,015	881,625	(1)	(1)	(1)
Indiana	370	8,953	149,821	370	8,953	149,821	(1)	(1)	(1)
Massachusetts	781	81,485	202,738	781	81,485	202,738	(1)	(1)	(1)
Michigan	358	3,433	58,712	358	3,433	58,712	...	...	...
Missouri	126	612	18,028	126	612	18,028	(1)	(1)	(1)
New Jersey	1,109	45,451	761,062	1,109	45,451	761,062	(1)	(1)	(1)
New York	2,774	146,375	1,237,737	2,774	146,375	1,237,737	(1)	(1)	(1)
Ohio	2,005	95,482	1,129,794	1,829	49,544	727,626	176	45,938	402,168
Pennsylvania	2,443	93,995	2,537,802	2,443	93,995	2,537,802	(1)	(1)	(1)
Wisconsin	1,225	20,146	294,483	1,225	20,146	294,483	(1)	(1)	(1)
All other states	1,588	448,296	3,812,432	[2] 440	[2] 19,791	[2] 103,496	[3] 1,148	[3] 428,505	[3] 3,708,936

[1] Included in "all other states."
[2] Includes states as follows: California, Connecticut, Kentucky, Maine, Minnesota, New Hampshire, Texas, Virginia, and Washington.
[3] Includes states as follows: Illinois, Indiana, Massachusetts, Minnesota, Missouri, New Hampshire, New Jersey, New York, Pennsylvania, and Wisconsin.

Before proceeding to a detailed discussion of dynamos as a class, it may be well, in view of the importance of the generic group of dynamo electrical machinery, to point out that the total value of dynamos and motors produced was $33,454,860. This does not include dynamotors, etc., which may be classed with transformers. Dynamos and motors constitute the largest single class of apparatus dealt with, and go into service in every department of electrical industry, either as the source of electrical energy or as the means of power distribution. These machines are employed chiefly in the three great departments, traction, lighting, and power, which are to-day frequently supplied from one power house, the electrical energy generated being manipulated by subsidiary devices to render it available for its specific use at the point of consumption. It is true that the value returned for insulated wire and cable was $34,519,699, but this material was supplied to all the electrical arts in varying proportions and no small part was required for use with the dynamos and motors, the installation of which demands these arteries of connection. In like manner the carbons, valued at $2,710,935, the arc lamps, valued at $1,574,422, and the incandescent lamps, valued at $6,953,205, were to a very large degree necessary supplies for the lighting arts that could not be carried on without the modern dynamo. Incidentally, also, it may be noted that no less an amount than $77,539,359 remained for other electrical products, exclusive of "amount received for custom work and repairing." This large amount embraced much apparatus dependent upon or associated with dynamo electrical machinery.

It will be seen from Table 3 that the value of dynamos reported in 1905 was very little in excess of that reported at the previous census, being $11,084,234 as compared with $10,472,576. As the other figures with regard to this class of apparatus indicate, the slight increase in value was associated with a very large increase in number and in horsepower; the number of machines built increasing from 10,527 in 1900 to 15,080 in 1905, while the capacity nearly doubled, rising from 770,832 horsepower to 1,328,243 horsepower. It is obvious from even a cursory consideration of these figures that a relatively small increase in the average size of the machines was accompanied by an enormous decrease in the cost per horsepower to the purchaser. The average size of machines reported in the earlier census was 73 horsepower, and this had risen in 1905 to 88 horsepower. Meantime, however, the cost had decreased from $13.59 per horsepower to $8.35. This change is due entirely to the great increase in the number of large machines in the power plants of central stations and electric railways. In earlier years the work of these plants was done chiefly with machines of very moderate capacity—50 horsepower being a respectable size for an arc lighting dynamo and 500 horsepower for incandescent lighting or electric railway work. The growing demand for current for all classes of service, and the greater distances and larger areas for which this current must be supplied, led to the adoption of alternating current dynamos generally associated with transforming apparatus to which the electrical energy could be delivered at the point of consumption, in order that, if necessary, direct current could be furnished to

trolley cars, storage batteries, arc lamps, etc. The whole process of the change is exemplified in the fact that, whereas the direct current machines averaged 47 horsepower in 1900, the 13,756 reported in 1905 had risen to an average of but 62 horsepower per machine, and the average size of the alternating current dynamos had risen from 254 to 358 horsepower. Moreover, while the direct current machines were ten times as numerous, they had not quite twice the total capacity of the 1,324 alternating current machines.

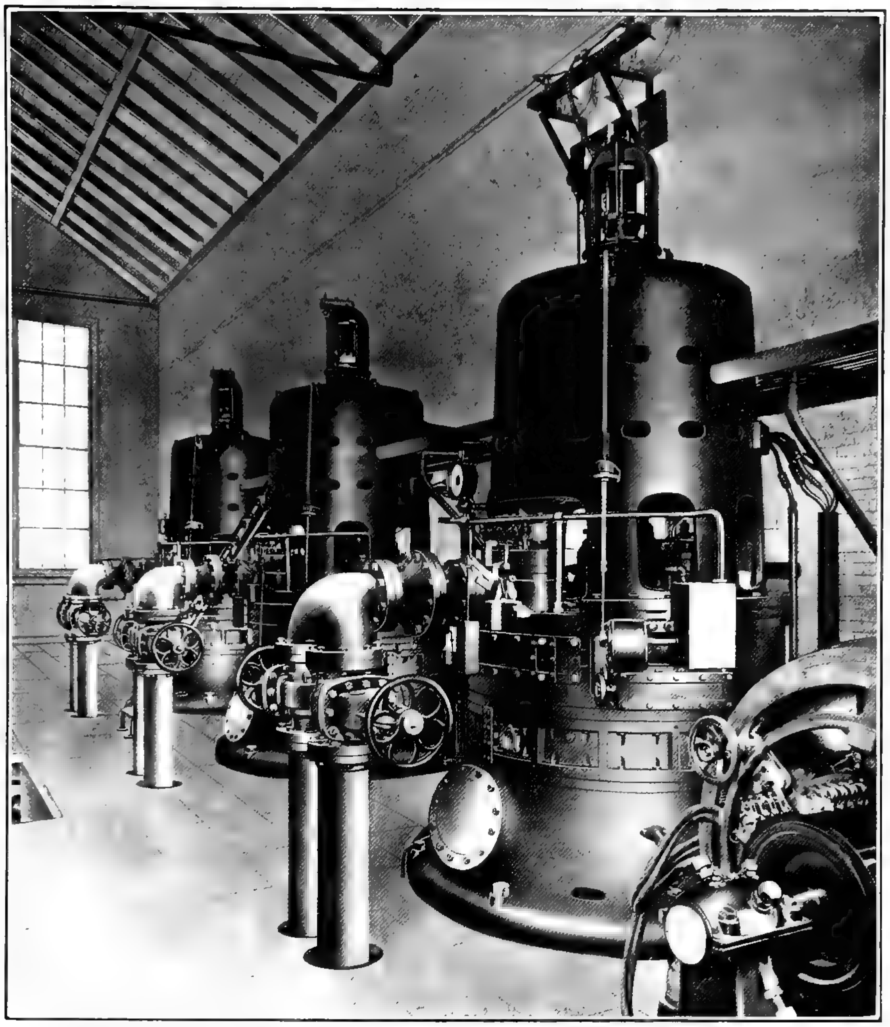
As these figures indicate, while the dynamo art as a whole has already undergone a great revolution with regard to its apparatus for producing current in bulk for great public utilities, and resorts increasingly to the use of alternating current, there is still an insistent demand for large numbers of small dynamos of the direct current type. Ten or fifteen years ago machines of from 50 to 100 horsepower were popular for arc lighting, but now the current for arc lamps is supplied quite generally from the gigantic machines which at the same time furnish current for incandescent lighting and for power. On the other hand, the adoption of electric lighting for steamships, large office buildings, isolated country estates, and scattered mills, factories, etc., has maintained a steady demand for direct current dynamos for incandescent lighting, many of them being employed also in the daytime to furnish electrical energy for motive power purposes. There is a marked tendency in the great cities to abandon the isolated plants in large buildings and to connect with the service mains of the central station companies, but at the same time many of these plants have capacity enough to supply an ordinary town, and being economically self-sufficient are likely to remain in operation indefinitely. A few plants in recent years have been installed on farms to be operated by wind or water power, but the number of these plants during the census year was too insignificant to warrant special inquiry. In many instances central stations have annexed large sections of rural territory to their circuits, thus supplying not only a city or large town, but a great number of farmers, dairymen, etc. Frequently the country districts secure current from the circuits of the interurban trolleys which now constitute so large a network in many of the more thickly settled regions of the country.

Probably a large proportion of the capacity of direct current dynamos is manufactured and employed especially for electro-chemical processes. Electroplating work is done with this type of current at such low voltages that the ordinary city current can not be employed for the purpose unless it is used to drive a motor which in turn operates the low voltage plating machines. It is, however, in electro-deposition and electro-chemical operations that such apparatus in its largest units finds the greatest demand. This is particularly true of the refining of copper. The first electrolytic copper refining process employed for industrial purposes was that of James Elkington, in Wales, in 1869, with an output of about 250 pounds of copper. A few years later the work was taken up in Germany, while in the United States only one plant is recorded as having been in operation as late as 1878. Until 1890 the development of this work was relatively slow, but since that time it has undergone enormous development, so that in 1905 nine large plants for the electro-deposition of copper were recorded as in operation in the United States, all of them employing large capacity, low voltage, direct current dynamos. The largest of these American plants has a capacity of refining 350 tons of copper per day. Not only is the economy of the process such as to explain this extension of electrical methods, but the value of the by-product is enormous, it being stated that at the Anaconda refinery alone over $200,000 monthly is recovered in gold and silver from the slimes of the copper vats.

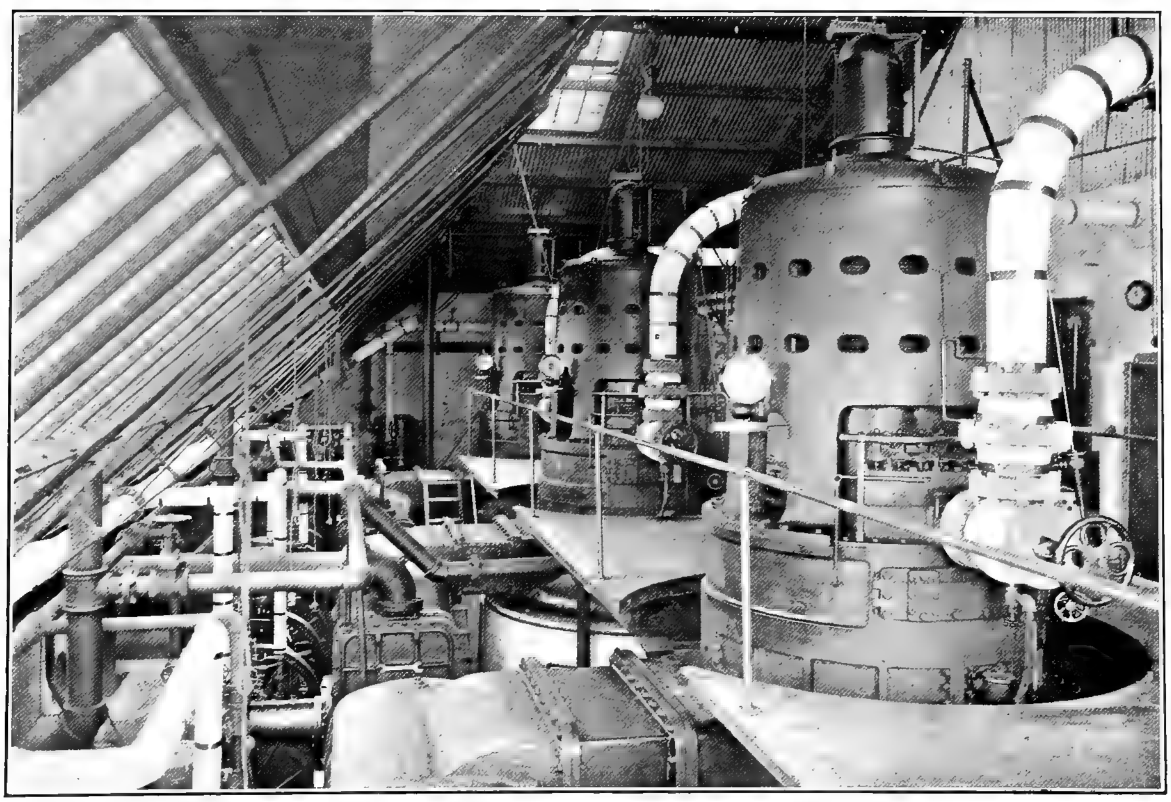
The alternating current dynamos included in Table 3 are of three types, their nature depending somewhat on the uses to which they have to be applied, namely, single phase, 2-phase, and 3-phase. In outward appearance and general characteristics these machines present a uniform appearance, but their style of construction depends upon whether they are to be operated by steam engines, gas engines, or driven by water turbines, and is modified again by the use of steam turbines instead of reciprocating engines.

In the earliest days of electric lighting, single phase alternating current dynamos were employed, but being utilized in a desultory way fell into unpopularity, which lasted until the great revival of alternating current methods about 1885. Then the increased use of incandescent lighting rendered it desirable to cover circuits of much larger area than was possible with the direct current apparatus of low voltage, as this current could not be delivered economically much more than a mile from the central station. The alternating current dynamo, generating current at high pressure and delivering its product to transformers miles apart, where it could be lowered in pressure for the consumption circuits of the customer, leaped swiftly into prominence and importance at this juncture. This created such a revolution in the art that to-day, for example, not one of the great Edison systems, in such cities as New York, Boston, Chicago, Philadelphia, etc., hesitates to restrict the employment of direct current dynamos to generate current at a pressure of 250 volts, or less, and generates alternating current in huge power houses only, transmitting this at pressures of 6,000 or 7,000 volts to substations where it is converted into low pressure direct current for distribution and use.

The earlier single phase apparatus was practically available for lighting purposes only and was usually employed with a large number of reversals of current per minute, the frequencies running from 60 cycles per second upward. Such current could not be used for



THREE 500 KILOWATT TURBINE DIRECT CONNECTED GENERATORS INSTALLED IN A RAILROAD REPAIR SHOP.



FACTORY EQUIPPED WITH STEAM TURBINE DYNAMO ELECTRIC UNITS FOR SUPPLYING LIGHT AND POWER.

electroplating or for charging storage batteries, and as no good motors of the alternating current type were available, the system lacked in flexibility and general availability, so that its advantages of being able to cover large areas were minimized. The difficulties thus encountered at this stage of the art were first settled in a large way in the electric railway field. The new trolley systems limited at first to small urban districts with a few cars and short run of track began to reach out for the suburbs, while the process of consolidation within urban limits brought large and successive increases of mileage to be energized with electric current from the same plant. The solution of the difficulty of supplying electrical energy in continuous volume over large areas for the propulsion of cars was found to consist in the abandonment of smaller direct current dynamos and their substitution by very large alternating current dynamos, whose current could be transmitted with slight loss for several miles and rectified or converted at substations, which in turn delivered the current to the lines at the voltage required for the operation of the motor. Analogous methods were immediately found to be economical in electric lighting, and the revolution was very quickly accomplished in both fields, the process of transition, however, being accompanied by the abandonment of single phase alternators in favor of the 2-phase, and more particularly the 3-phase type.

One of the modifications of manufacture in nearly all dynamos of this type has been their self excitation and compounding with alternating current. In the earlier practice small direct current machines were employed, driven by separate engines or by turbines to furnish the current in exciting the field of single phase or polyphase alternators. A further step was illustrated in the Niagara plant, where the current for exciting the fields of the generators was obtained directly from synchronous converters, which in turn were supplied with alternating current from the generators—static transformers, however, being interposed to reduce the potential. In this manner alternating current at about 125 volts potential was delivered to the collector of the rotary converter, and from the direct current commutator of the other converter current was delivered at a potential of 175 volts to the generator fields. The next step has been to lead the current generated by the machine directly to the field windings for excitation and compounding by means of a peculiar commutator device. By the interposition and suitable interconnection of transformers, or by certain circuit arrangements in a single transformer, the exciting current of the machine is taken off in shunt to the main winding and the compounding current in wattless series, and so conducted to the commutator that the exciting current remains approximately constant for all loads, while the compounding increases and decreases with the wattless component of the main current. The main feature of the machine is the commutator and the connection of the field windings to it. At the time of this report the self-excitation of the alternators has become a general practice, but their compounding within the machine itself, while regarded as effective, is an expensive process. There are other devices for large alternators which are altogether outside of the machine, and which do not increase the cost of the machine itself.

With the introduction of the steam turbine in place of the reciprocating engine, as will be further noted below, there has come into vogue a new class of dynamo electrical machinery, whose characteristics are determined largely by the fact that the turbine operates at a high speed and thus permits large amounts of power to be produced and handled within a very small space. The dynamos in this class become so much an essential and integral part of the machine that a new name has been coined to designate them and they have become universally known as "turbo-generators." It will be readily understood that where a type of apparatus running at approximately 300 revolutions per minute undergoes a change by which it is operated economically and efficiently at 3,000 revolutions per minute, economic and engineering advantages present themselves, and these will explain the rapid development of the product in the turbo-generator field during the census year. It is significant of the pertinent relations of these advantages to dynamo construction that in the United States the construction of these turbo-generator units has been begun and fostered almost wholly by dynamo electrical manufacturers, and up to the present moment has remained in their hands to such an extent that two or three of the leading steam turbine manufacturers, who also build dynamos, may be said to control the production of certainly not less than 75 per cent of the steam turbine output, whether for dynamo operation or simply for the other purposes to which steam engines have hitherto been applied.

The best illustration of the use of 2-phase alternators is to be found in the power transmission field, particularly at Niagara Falls and on the Pacific coast. The first large utilization of Niagara power was made in a plant of 50,000 horsepower, composed of 10 vertical shaft turbines, each directly connected, by means of a long shaft in the wheel pit, to a 2-phase alternating current generator of 5,000 horsepower capacity. This was supplemented in 1904 by another power house containing 11 generating units of the same type and capacity, affording a total output for the plants of 145,000 electrical horsepower. Each machine is made for generating electrical energy in the condition of 2-phase, 25-cycle current with a potential of 2,300 volts in the machine and operating at a speed of 250 revolutions per minute. In the earlier plants the alternating dynamos were all of the external revolving

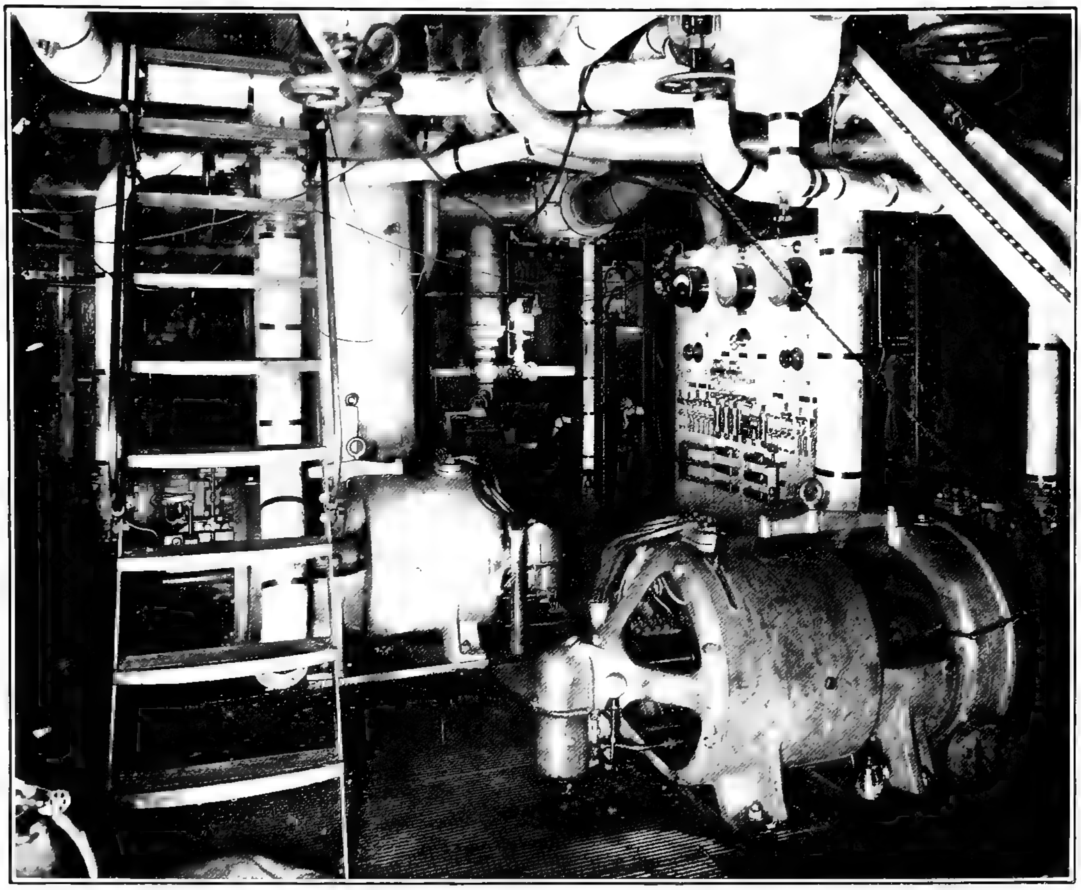
field or umbrella type. In other words, contrary to the ordinary practice of the time, the armatures were made stationary and the field magnets revolved and inclosed the armature. In the second power house several of the machines are of the internal field-magnet construction; that is, the field magnet has been placed within the armature.

The next step was the design and construction in America of even larger apparatus of this type for the development of power on the Canadian side by the Dominion branch of the American corporation known as the Niagara Falls Power Company. The unit adopted for this was of double the size and capacity, namely, 10,000 horsepower, and wound for 12,000 volts 3-phase instead of 2-phase. The rapid advance in the art is shown in the fact that not only was the unit thus doubled in size within a year or two, but the voltage generated within the machine was increased from 2,300 to 12,000, an enormous stride in manufacturing skill. The new 10,000-horsepower unit occupies only slightly more space than that of one of half the capacity, which results, for a given plant output, in great reduction in length of wheel pit, power house, and fore bay, and a consequent reduction in expense of construction of the hydro-electric plant as a whole. This latest type of large generator driven by waterpower is of the internal field vertical shaft type, the turbine being at the lower extreme end of the long shaft in the wheel pit. The revolving field ring is built up of laminations bolted together with lapping joints, a method which gives a uniform and definite strength of ring with a high magnetic permeability. On account of the high speed of 250 revolutions per minute the generator is small compared with some large steam engine driven units, its over-all diameter being only about 19 feet. The weight of the revolving part of the machine, namely, the field magnets, is 141,000 pounds. The change from 2-phase to 3-phase in these later machines was made at Niagara for the reason that in distributing large amounts of power underground from a 2,300-volt 2-phase plant it becomes cheaper to transform, after a radius of about one mile is exceeded, to 12,000-volt 3-phase and distribute at that voltage. Hence it follows that greater economy of plant construction and operation is secured by the employment of these larger units, directly generating the useful current within themselves at the higher voltage and thus dispensing with transformers. It will be understood, of course, that for the delivery of electrical power at such distant places as Buffalo, Rochester, Syracuse, Toronto, etc., long distance step-up transformers are still employed, raising the voltage to 22,000, 40,000, or 60,000 volts.

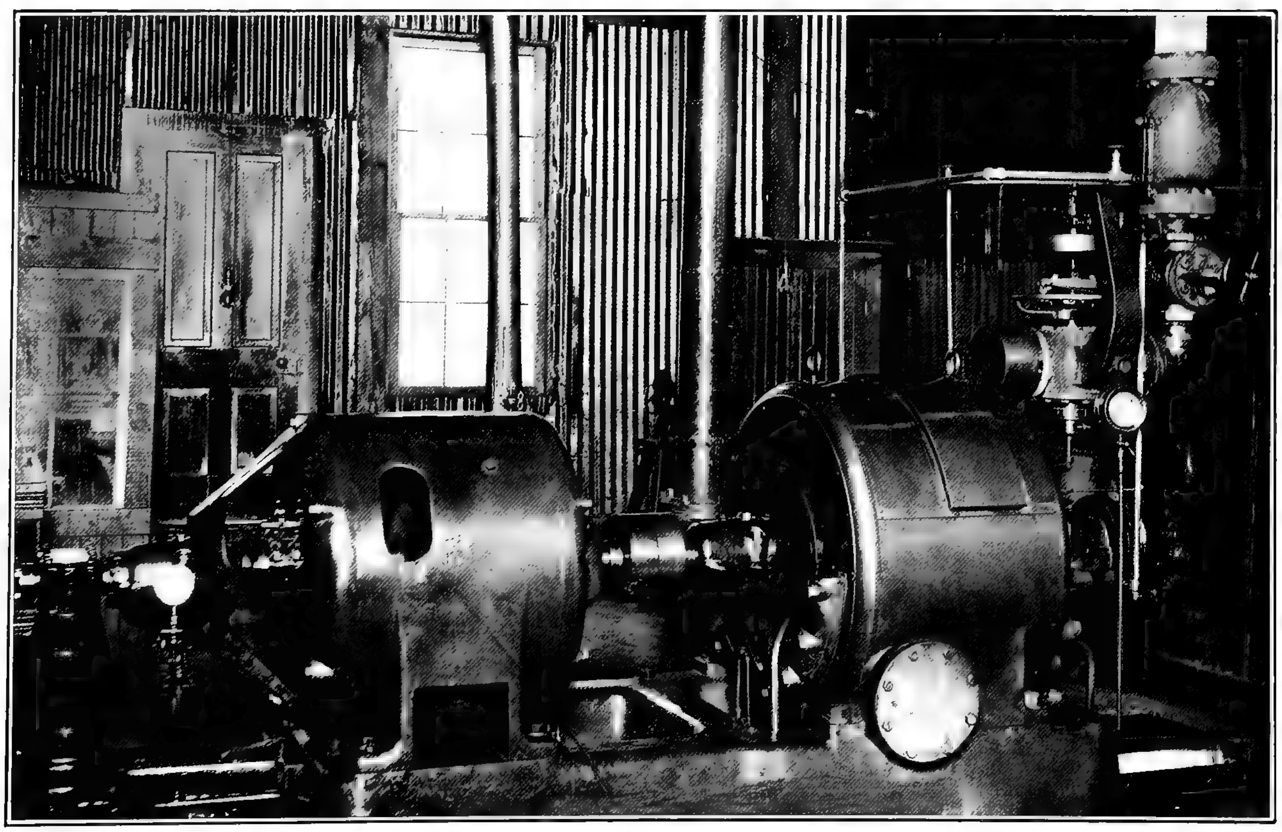
An altogether new departure in dynamo construction has been introduced by the adoption of steam turbines as the prime moving agent, the new practice giving rise to many special problems of a mechanical and electrical nature. Briefly stated, it may be said that the essential feature of a steam turbine consists in a set of nozzles or blades through or against which steam at high pressure passes so as to strike upon another series of angularly placed plates, vanes, or cuts mounted upon a rotating shaft, the whole being inclosed in an outer case or chamber, and the rotating shaft of the turbine carrying the rotor member of the dynamo-electric machine. The arrangement of the turbine or of its parts is such that the steam which has impinged upon a first set of plates or vanes is led through a second set of orifices so as to encounter a second set of plates or vanes during a further expansion, this process being repeated until the steam has virtually lost its useful driving power. The steam in expanding in this manner, adiabatically, acquires a great velocity, the potential energy of its heat being converted into kinetic energy in movement, which is transferred to the device upon which it impinges, so that the potential energy of the steam is converted into work through the rotation of the shaft upon which the receptive plates or vanes are mounted. There is already a variety of constructions of the steam turbine type upon the market, almost all of them designed primarily for the operation of dynamo-electric machines. It is not necessary here to enter into the principles of steam turbine construction, but it is essential to note the main features of the electrical constructions that have resulted from the adoption of the turbine as a prime motor.

Some idea of the extent of the new development may be formed from the fact that during the year ending in April, 1906, the two largest concerns in the American field of dynamo construction received orders to manufacture in one case a total of 188 steam turbines with a total capacity of 220,250 kilowatts, and in the other case 323 turbo-units with an aggregate capacity of 221,175 kilowatts, a total of not less than 441,425 kilowatt capacity. As these were not the only ones produced in the field, it will at once be perceived how enormous a proportion of the addition to the aggregate capacity of American dynamo-electrical machinery the turbo-generators represented in the year of the Census report. The average turbine appears to have been of about 1,000 kilowatt capacity, although the units ran down to as small sizes as 15 kilowatts, or about 20 horsepower.

As already noted, these turbo-generators are of two types, the horizontal and the vertical. In the case of the leading horizontal type made in the United States, the dynamo end of the turbo-generating unit may be said to follow with fair closeness the precedent methods of construction. Two frequencies of current are standard, one of 25 cycles per second for railway and power work, and one of 60 cycles per second for lighting. The character of the generator determines the speed of



STEAM TURBINE GENERATOR SETS IN ENGINE ROOM OF A HUDSON RIVER STEAMBOAT.



TWENTY-FOUR HUNDRED KILOWATT STEAM TURBINE GENERATOR AT A COAL MINE IN KENTUCKY.

the turbine units, and vice versa. For instance, the 25-cycle generator, which at 1,500 revolutions per minute has 2 poles, has 4 poles at 750 revolutions. The generator has a revolving field structure, small in diameter and finished smooth, to minimize windage, ventilation being secured by ducts cut in solid steel. The standard construction of laminated armature is employed and the structure is well ventilated by air ducts between the laminations, to communicate with the interior air by means of slots or openings in the frame. According to the voltage and current capacity of the machine the windings are of wire, bar, or strap copper, and they are thoroughly protected by embedding them in closed slots in the laminations of the armature. The largest types of such machines are exemplified by the 1,250-kilowatt units furnished for the Interborough Rapid Transit plant in New York city. There the horizontal turbo-generator units are of the revolving field type, delivering 3-phase, 60-cycle current directly to the distributing system at a pressure of 11,000 volts. Each unit operates at a speed of 1,200 revolutions per minute, therefore requiring a 6-pole magnetic field. The capacity at full load is 1,250 kilowatts, with 25 per cent steady and 150 per cent intermittent overload capacity. Tests made on these machines show an average efficiency of 96.5 per cent at one and one-fourth full load, 96 per cent at full load, 95 per cent at three-fourths load, 92.7 per cent at one-half load, and 86 per cent at one-fourth load. These efficiencies are calculated from the measured electrical and magnetic losses, the bearing friction and the windage loss not being included. The short-circuit current of the generator is approximately three and one-fourth times the full load current. The generator has been run under test on open circuit for nearly twelve hours at 12,150 volts with full excitation. Under these conditions the maximum rise observed in temperature in the stationary iron of the machine was only 26.7° C. and the rise in the temperature of the field structure was 16.7° C.

The other leading distinctive type of dynamo-electric machine, driven by steam turbine, is vertical instead of horizontal. The leading example of this may be described as a type which, in addition to having nozzles delivering steam at high velocity to a single wheel, has also stationary vanes that redirect the steam which has been discharged from the first wheel into the second wheel. The design of this entire unit, electrically and mechanically considered, has embodied many radical features as compared with other similar apparatus. The shaft, as noted, is vertical and the whole weight of the revolving part is borne in the smaller or earlier designs by an oil film maintained by a pressure pump at the lower bearing. The delivery of steam to the turbine part is controlled through a system of electrically operated individual valves worked by a small controller, a centrifugal governor moving the controller. The revolving field structure of the dynamo is mounted upon the same shaft as the turbine wheels, and above them in the same common casing. The stationary part of the generator is supported by the stationary portion or casing of the turbines, the whole apparatus being built up, in a machine that is rated at 5,000 kilowatts, into the general form of a vertical cylinder about 25 feet high and 14 feet in diameter. The total weight of such a machine complete, including turbine and generator, is 400,000 pounds, with the capacity as stated of 5,000 kilowatts load, and capable of running at about 75 per cent overload condensing, and at nearly full load noncondensing. The first large machine of this type was built for the Chicago Edison Company, and among the latest are those for the New York Edison Company, in which the size has been carried up to 8,000 kilowatts with 50 per cent overload capacity for two hours. This unit at the base is slightly over 15 feet, while the height over the governor dome is 32 feet. The total weight is approximately 700,000 pounds. In accordance with the latest practice of the manufacturers the water type of step bearing is used instead of the oil film type for supporting the weight of the vertical shaft. These turbines are designed to operate under a steam pressure of 175 pounds with 100 degrees of superheat. Their rating permits them to carry a load of 9,000 kilowatts for twenty-four hours of steady running and their overload capacity of 15 per cent, or not less than 16,000 horsepower is guaranteed for two hours as stated. These generators are of the 4-pole type, and operated at a normal speed of 750 revolutions per minute will deliver 3-phase current at a potential of 6,600 volts with a frequency of 25 cycles per second. As will be seen, the leading feature in this latest development is the increase of speed from the 500 revolutions per minute of the earlier 5,000 kilowatt units. With regard to this vertical type of turbo-generator carried up into such large sizes, it is said that compactness and simplicity are resultants of the design, while lateral strain is removed from the bearings which align the shaft, and all deflection of shaft is avoided. To carry such weights as are necessary in the revolving parts of these large units, many very large bearings would be required if the shaft were in a horizontal position. It would also be difficult to so support the wheels that their clearances would not be affected by the sagging of the shaft nor by looseness in the bearings. It might be equally difficult to place the wheels with such a relation to each other that the clearance would not be affected by any expansion of the shaft. In the vertical design the space between the wheels is feasibly reduced to a minimum. The supporting structure is symmetrical and it can not be distorted or put out of line either by the mechanical or steam pressure strains or by the effects of expansion.

Be this as it may, it is the fact that at the period of dynamo-electric construction closing with this report,

the turbo-alternators, whether of the horizontal or the vertical type, had become dominant in the field of the production of electrical energy, whether supplied for street railways, for electric lighting, or for power purposes, and their future preeminence was no longer doubtful except so far as the new and larger types of gas engine may be made an economical and mechanical success in the propulsion of dynamos. For such work, three direct connected dynamos were built during 1905 to be driven by gas engines, each with a capacity of not less than 4,000 kilowatts. These interesting units were built for operation in San Francisco, but their operation and testing has been delayed by the catastrophe which visited that city early in 1906.

Closely associated with dynamos is the group of apparatus comprising double-current generators, dynamotors, motor generators, boosters, and synchronous converters, statistics for which are as follows:

TABLE 4.—*Dynamotors, motor generators, and boosters—number, horsepower, and value: 1905 and 1900.*

STATE.	Number.	Horse-power.	Value.
United States, 1905	2,135	279,552	$1,740,534
1900	649	14,397	[1] 379,747
States, 1905.			
Illinois	668	529	29,828
New Jersey	129	2,867	22,006
Ohio	106	23,948	185,567
All other states [2]	1,232	252,208	1,503,133

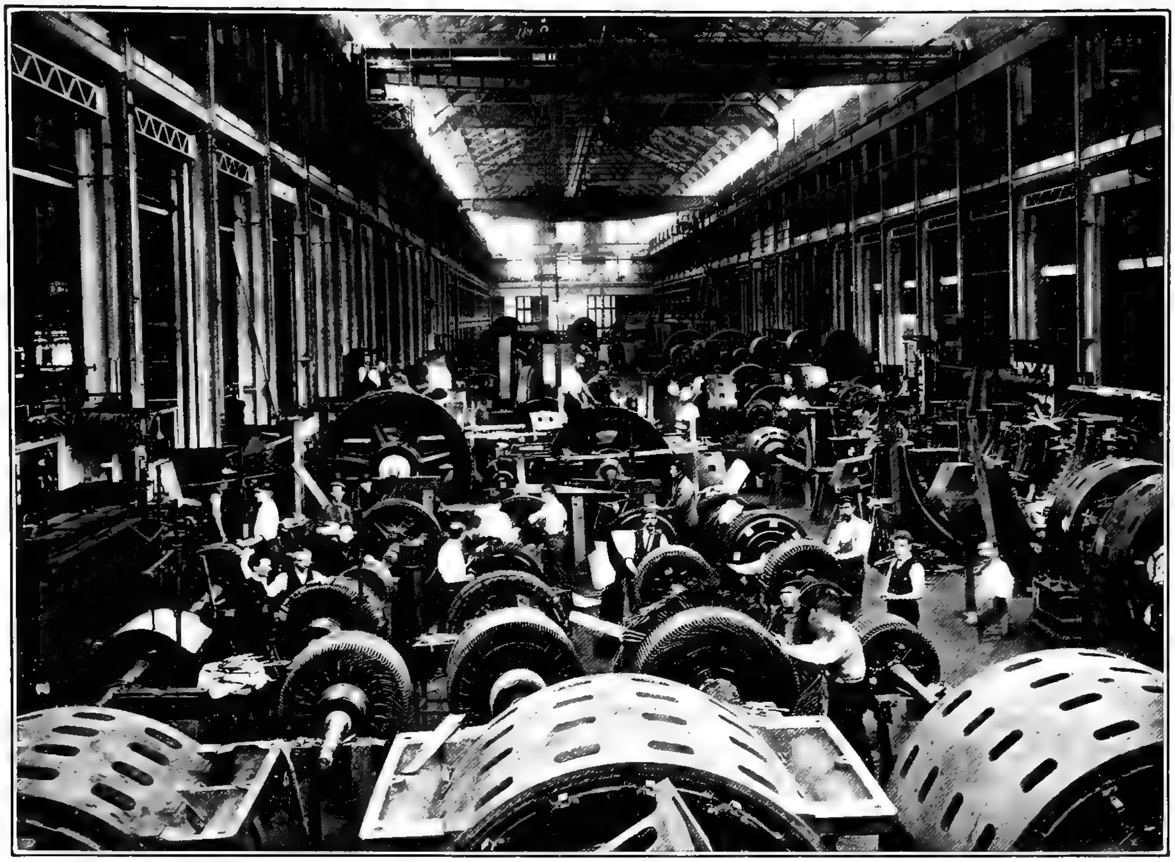
[1] Includes dynamotors, motor generators, and boosters to the value of $25,000 for which number and horsepower were not reported.
[2] Includes states as follows: Indiana, Kentucky, Maine, Massachusetts, Minnesota, Missouri, New York, Pennsylvania, Texas, Virginia, and Wisconsin.

The statistics of Table 4 include 2,135 machines of this type of a total capacity of 279,552 horsepower, valued at $1,740,534, for the census of 1905. All this apparatus embodies the striking characteristics of the generating apparatus by which mechanical energy is converted into electrical energy, but, except in the case of the double current generators, a small and limited group is employed for the manipulation of current so as to render it more readily and economically available in the consumption circuits. As already noted, practically all the 2-phase and 3-phase current generated by the machines enumerated in the preceding paragraphs passes through synchronous converters, by which it is transformed to direct current for charging storage batteries, driving motors, energizing lamps, or setting into operation electro-metallurgical and electro-chemical processes.

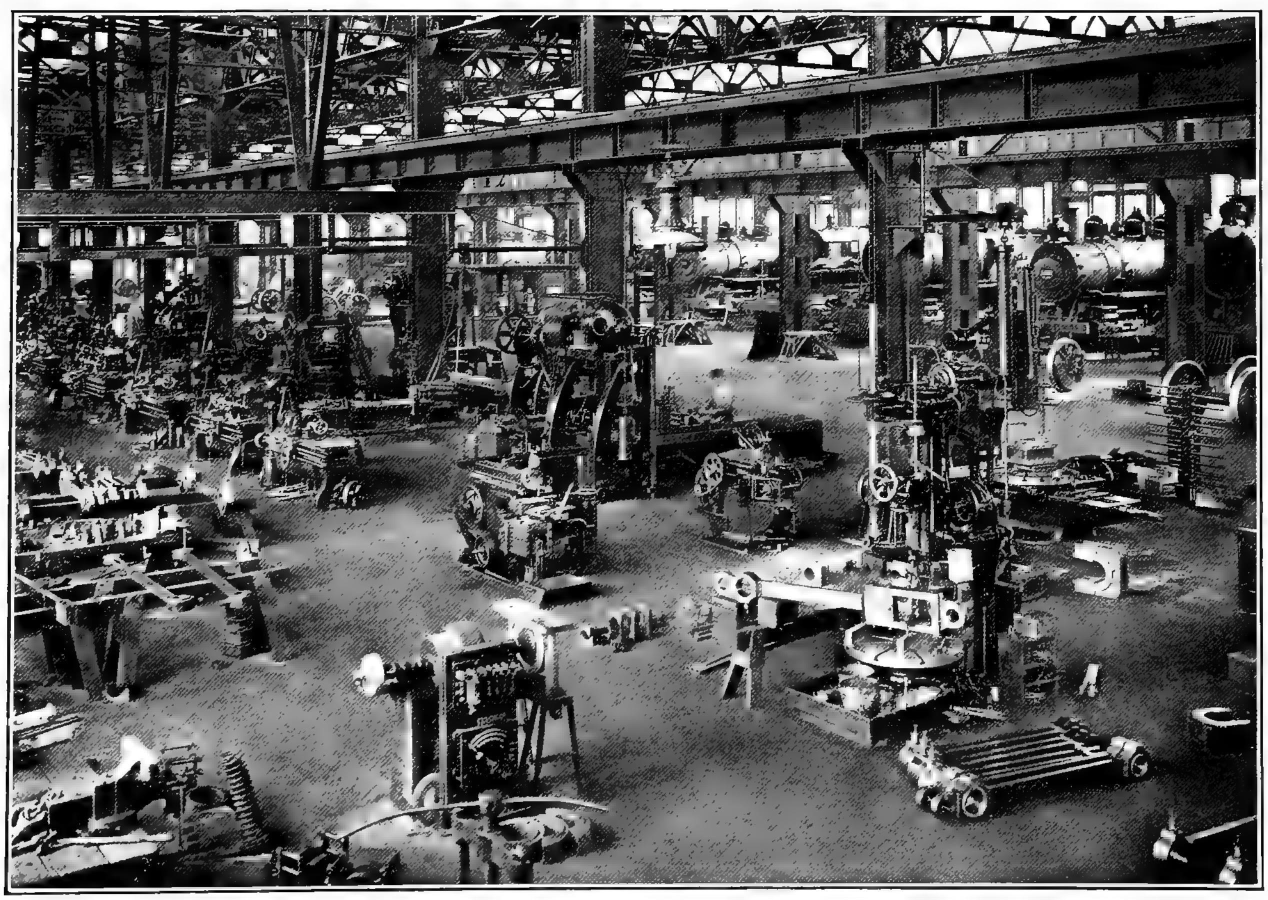
The synchronous converter is a dynamo-electric device receiving the alternating current on one side and delivering direct current on the other side, or vice versa. This type of machine is more particularly favored in America than are the motor generators, where the receiving part of the transformer system is a separate machine mounted on the same shaft as the delivering machine, which is connected to the consumption circuits. In the last year or two motor-generator devices of a large type have come into more general use in America, hence some of them are included in these figures. Of course it will be understood that a synchronous converter can be, so to speak, inverted, and the practice is sometimes found to prevail of driving the machine as a direct current motor, taking electrical energy from direct current supply mains through its commutator and delivering this energy in the form of alternating current from its collector rings. These rotary converters are now often built in units of several hundred horsepower and the substations in which they are located are themselves much larger than were the generating plants of a few years ago. In New York city to-day, while there are barely a half dozen large generating plants located at the water's edge, there are scores of these distributing stations scattered all over the city in which the synchronous converters are located; and the same general disposition is true of the extensive power transmission systems and interurban railroads now to be found in so many of the rural and mining districts of the country.

The dynamotor has been quite extensively manufactured for telegraphic purposes. Its principle is that of receiving the current from a general source of supply and then delivering another current from the same machine at the required voltage for any one of the numerous telegraphic circuits, each to be supplied with a different current. In the dynamotor the two armature windings are usually placed upon the same armature core and are acted upon by the same flux magnet. The object of this construction is to secure compactness and enable the armature reaction of the dynamo to neutralize that of the motor, thus avoiding troubles the chief of which is sparking at the commutator. This method has been found open to the objection, however, that it is somewhat difficult to insulate the two windings from each other and to prevent the high voltage in one from breaking through to the other. A further development of the same idea to secure independence of action between the motor and the dynamo portions of the dynamotor or "rotary transformer"—as it is sometimes called—is to carry the separate armature windings upon separate cores and to allow each to be acted upon by its own field magnets, thus permitting the field of the dynamo to be independently regulated in order to vary the voltage that is generated. In some cases the separate armatures are mounted upon the same shaft with one set of bearings and the two machines are arranged upon the same base or bedplate, sometimes with an intermediate bearing, in which differentiation they approach again the motor generators already described.

As a general thing, while there is some looseness of phraseology about the matter, the term "dynamotor" is applied to the smaller transforming units employed in telegraphic work, etc., and the idea of the synchronous converter is associated with the



WINDING ARMATURES FOR ELECTRIC GENERATORS.



RAILROAD SHOP WITH TOOLS EQUIPPED WITH MOTORS ON MULTIPLE VOLTAGE SYSTEM.

kindred machines doing the heavy work of lighting and power.

Double current generators are machines of the synchronous converter class, for since the synchronous converter is provided with a single armature winding connected to a direct current commutator and the alternating current collector rings, it is evident that if such a machine be driven by outside mechanical energy, it can be made to generate both direct and alternating current; and as a matter of fact in some plants such machines are employed as converters at one period and as generators at another time. One early and typical use of such work was furnished in the installation of the Chicago Edison Company a few years ago, when double-current generator units were installed for the purpose of cross-connecting the generating stations, in order to enable one plant of the system to help out another as desired.

Motors.—Table 5 presents the statistics of the production of electric motors at the censuses of 1900 and 1905.

TABLE 5.—MOTORS—NUMBER, HORSEPOWER, AND VALUE: 1905 AND 1900.

STATE.	Aggregate value.	FOR POWER.								
		Total.			Direct.			Alternating.		
		Number.	Horsepower.	Value.	Number.	Horsepower.	Value.	Number.	Horsepower.	Value.
United States, 1905	$22,370,626	79,877	678,910	$13,120,948	54,242	382,997	$10,254,854	25,635	295,913	$2,866,094
1900	19,505,504	35,604	515,705	7,551,480	29,615	378,329	5,786,052	5,989	137,376	1,765,428
States, 1905:										
Illinois	446,490	4,321	15,632	384,540	4,321	15,632	384,540	(1)	(1)	(1)
Indiana	229,417	1,509	7,890	229,417	1,509	7,890	229,417			
Massachusetts	1,151,111	19,788	78,161	1,151,111	12,760	68,207	770,761	7,028	9,954	380,350
Missouri	474,016	8,602	8,982	474,016	1,302	1,809	46,631	7,300	7,173	427,385
New Jersey	2,068,889	14,406	76,370	1,692,167	14,406	76,370	1,692,167			
New York	3,213,540	8,440	182,361	2,030,627	2,781	44,899	641,996	5,659	137,462	1,388,631
Ohio	993,457	5,704	33,183	717,780	5,704	33,183	717,780	(1)	(1)	(1)
Pennsylvania	5,171,143	5,886	95,048	5,066,997	5,886	95,048	5,066,997	(1)	(1)	(1)
Wisconsin	1,648,208	4,975	34,164	590,184	4,975	34,164	590,184			
All other states	6,974,355	6,246	147,119	784,109	[2] 598	[2] 5,795	[2] 114,381	[3] 5,648	[3] 141,324	[3] 669,728

STATE.	FOR RAILWAYS.			FOR AUTOMOBILES.			FOR FANS.			FOR ELECTRIC ELEVATORS.			MISCELLANEOUS.		
	Number.	Horsepower.	Value.	Number.	Horsepower.	Value.	Number.	Horsepower.	Value.	Number.	Horsepower.	Value.	Number.	Horsepower.	Value.
United States, 1905	12,298	713,181	$4,949,795	1,819	19,907	$152,685	102,535	30,796	$1,168,254	1,333	13,398	$638,473	8,481	36,820	$2,340,471
1900	15,284	666,669	7,568,841	3,017	8,220	192,030	97,577	12,766	1,055,369	385	6,730	[4] 2,523,901	7,913	11,392	613,883
States, 1905:															
Illinois	(1)	(1)	(1)	(1)	(1)	(1)	6,203	529	56,800	38	335	5,150	(1)	(1)	(1)
Indiana							(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Massachusetts	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Missouri							(1)	(1)	(1)	(1)	(1)	(1)			
New Jersey	(1)	(1)	(1)				24,513	9,101	319,188	233	2,482	57,534			
New York	(1)	(1)	(1)				3,908	1,292	76,238	(1)	(1)	(1)	3,563	3,565	1,106,675
Ohio	(1)	(1)	(1)	194	382	24,451	15,193	2,538	175,386	138	1,290	30,085	258	2,264	45,755
Pennsylvania	(1)	(1)	(1)	(1)	(1)	(1)	4,375	970	49,647	263	2,425	54,499	(1)	(1)	(1)
Wisconsin										(1)	(1)	(1)	3,300	24,572	1,058,024
All other states	[5] 12,298	[5] 713,181	[5] 4,949,795	[6] 1,625	[6] 19,525	[6] 128,234	[7] 48,343	[7] 16,366	[7] 490,995	[8] 661	[8] 6,866	[8] 491,205	[9] 1,360	[9] 6,419	[9] 130,017

[1] Included in "all other states."
[2] Includes states as follows: Connecticut, Kentucky, Maine, Michigan, Minnesota, New Hampshire, Virginia, and Washington.
[3] Includes states as follows: Illinois, Ohio, Pennsylvania, and Virginia.
[4] Includes motors valued at $2,008,455 for which the number and horsepower were not reported; and 60 motors, valued at $261,722, for which the horsepower was not reported.
[5] Includes states as follows: Illinois, Massachusetts, Michigan, New Jersey, New York, Ohio, and Pennsylvania.
[6] Includes states as follows: Colorado, Illinois, Massachusetts, and Pennsylvania.
[7] Includes states as follows: Colorado, Indiana, Maine, Massachusetts, and Missouri.
[8] Includes states as follows: Indiana, Maine, Massachusetts, Minnesota, Missouri, New York, Virginia, and Wisconsin.
[9] Includes states as follows: California, Colorado, Illinois, Indiana, Kentucky, Maine, Massachusetts, Michigan, and Pennsylvania.

Table 5 shows a substantial advance in number and horsepower over the preceding census year, accompanied by a smaller proportionate increase in the total value. As in the case of dynamos, the larger sizes and the greater number produced may be held to explain directly the smaller cost of apparatus to the purchasing public. The extraordinary fact emerges that the value of the motors built was twice as great as that of the dynamos. During the past five or six years, as evidenced by the statistics of power employed in manufactures, the use of electric motors has become almost universal, so that relatively few new mills or factories of any size are established in which the power is not distributed largely by means of electric motors attached directly to the tools or machines, or by short lines of shafting. This change has been facilitated by the general introduction of electric lighting in industrial establishments, so that the same power plant gives forth its electrical energy for the motor by day and for illumination by night. It is interesting to note that no fewer than 79,877 direct and alternating current motors of a total of 678,910

horsepower were built in 1905 for industrial power and kindred motive purposes, with a value of $13,120,948, giving an average size of 8½ horsepower to the motor and an average value of about $19 per horsepower.

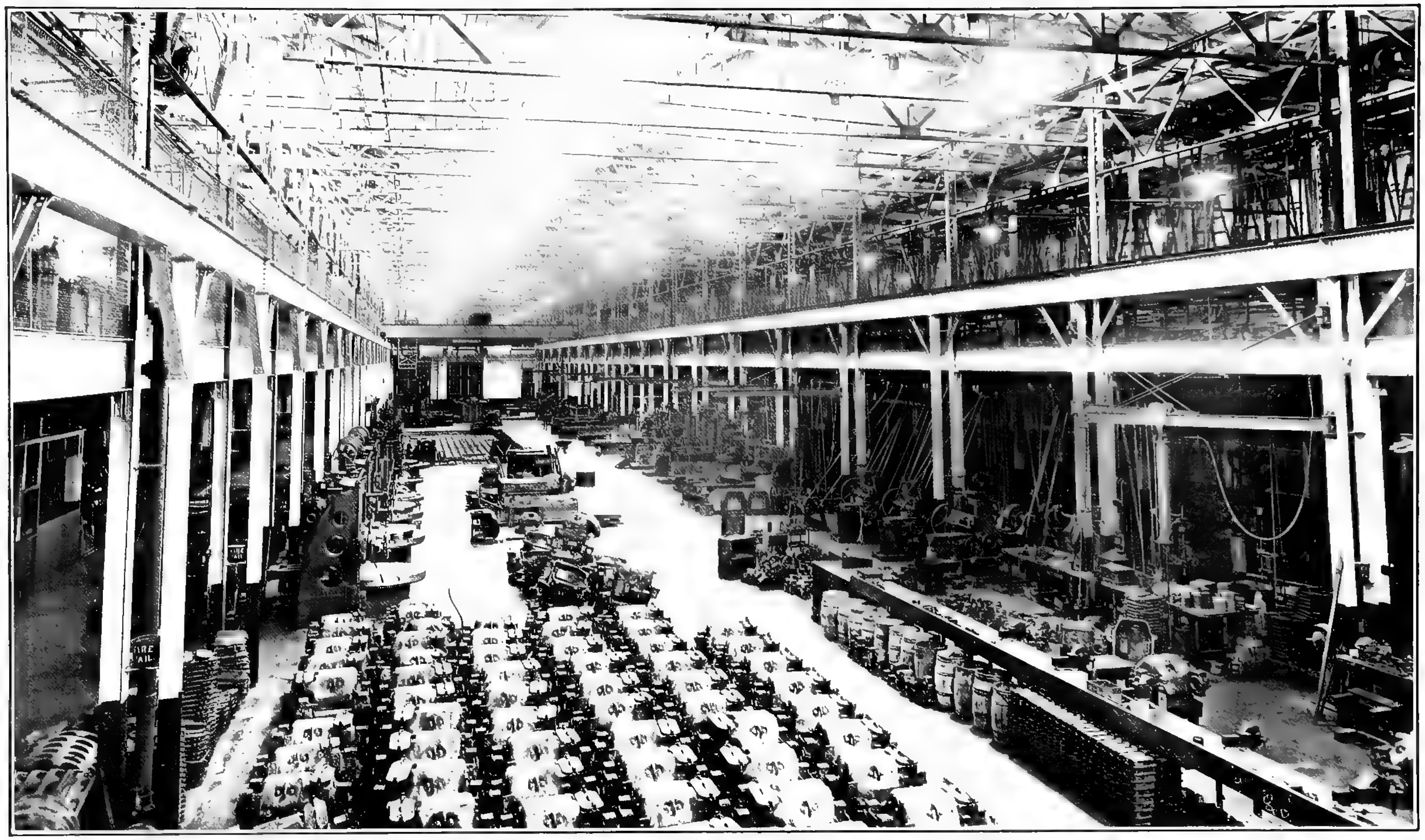
In the street railway field the number of motors required from the manufacturers had actually decreased, being only 12,298, as compared with 15,284 in the year 1900. They had increased, however, in size, but had fallen notably in value, as the capacity was 713,181 horsepower, reported at $4,949,795; whereas in the previous period 666,669 horsepower was returned at a value of $7,568,841—a decline from nearly $11.50 per horsepower to less than $7. This difference was obviously brought about by the gain in size, the railway motors at the census of 1905 having an average size of 58 horsepower as compared with 44 only five years ago. Of course this size is notably exceeded in motors intended for the replacement of steam locomotives, as will be noted below in more detail, but it is also the fact that the larger and longer cars now employed on almost all the electric street railways have necessitated the use of larger motors for their propulsion.

In the automobile field the only serious relative decline is noted with respect to the utilization of electric motors. In 1900 there appeared great likelihood that the electric automobile might advance to perfection as rapidly as other branches of electrical appliances had done, but in general the results have been unsatisfactory, due to the fact that the storage batteries installed have not been able to withstand the excessive jarring and jolting to which they are subjected on uneven roads and poorly paved streets. At the same time even the electric automobile motor has held its own, for while the number is a little more than one-half and the value has decreased considerably, the capacity has increased from 8,220 to 19,907 horsepower. Here again the question of size has had a material influence, and the average capacity of automobile motors has grown from 2½ horsepower to 11 horsepower. This condition is due to the fact that the employment of the electric automobile has very largely shifted from the field of pleasure vehicles to that of industrial types, drays, delivery wagons, etc. Confirmation of this point of view is found in the statement of one manufacturing concern in September, 1905, that in the four years immediately preceding it had built, equipped, and put in operation some 800 electric automobiles for 300 different concerns, nearly all of these machines being intended for industrial purposes.

The electric fan, which has now become a staple electrical product, is shown to have reached over 100,000 a year, valued at more than $1,000,000. As a matter of fact, the type for office use has not varied greatly, being standardized at a fraction of a horsepower. But on the other hand, improved methods of ventilation in theaters, halls, hotels, hospitals, etc., have called for larger sizes, so that while the 97,577 made in the year 1900 had a capacity of only 12,766 horsepower, an average of over one-eighth of 1 horsepower, the 102,535 produced at the census of 1905 had a capacity of 30,796 horsepower, or nearly one-third of 1 horsepower each. Again, it was due to the increase in the size and capacity that the value has been materially reduced. In fact, the electric fan, when regarded upon the horsepower basis, appears to be extravagantly costly as compared with power motors or street railway motors, the average price per horsepower in 1900 having been about $83; but this can readily be accounted for when it is remembered that the average fan motor for desk or countingroom would readily sell at $10 or $12, with a capacity of one-sixth or one-eighth of 1 horsepower. At the census of 1905 the value per horsepower had fallen to much less than half, namely, $38 per horsepower, indicating not only the lower cost of the older, smaller types of fan motor, but the use of a great many ventilating fans of from 2 to 5 horsepower each, so that the prices more closely approximate those for motors of equal rating in other fields of application.

There is no opportunity to compare the relative number and capacity of motors made for electric elevators, as in most cases only the value was given in 1900; but even allowing for an increase in size, it may be questioned whether the decline in value can be accounted for solely upon the supposition of a reduction in price. The electric elevator, which has lately exhibited a spurt of activity, has for some years past had to encounter the opposition of hydraulic and "plunger" types vigorously pushed, and is understood to have barely held its own in the twenty to thirty story buildings now to be found in the larger cities; but there is reason to believe that many of the motors returned under those employed for motive power purposes should have been reported as employed in the elevator and hoisting class, which would have tended to place these figures more upon an equality, with fuller justice to the electric elevator. It is a matter of fact that a large number of new apartment houses in large cities are being equipped with elevators propelled by direct and alternating current motors, and the central station companies report a considerable demand for this class of service.

It should be understood that in both the fan motor and the electric elevator class a large proportion of motors are of the alternating current type, but no differentiation was made in securing the census data. This differentiation would apply equally to the motors enumerated under "miscellaneous." Of these, no fewer than 8,481 were reported for the census of 1905, with a capacity of 36,820 horsepower and a value of $2,340,471. It is to be noted that the motors in this group ranged higher in price per horsepower in 1905 than those in any other category, a fact explained by their small average size and by the variety of their application; spe-



FLOOR OF ELECTRIC FACTORY FOR ASSEMBLING ELECTRIC RAILWAY MOTORS.

cial design and construction being necessary in many instances—as, for example, their use on submarine boats, on board men-of-war for handling ammunition and guns, in exposed places for building operations, in mines for drilling and coal cutting, in post-offices for stamping letters, and in a variety of other uses equally dissimilar and heterogeneous.

The electric motors applied to motive power purposes in industrial establishments are, as the statistics show, of either the alternating or the continuous current type, subdivided again into various groups and classes, determined chiefly by the work to which they are applied. Some motors are designed and supplied to afford constant speed or variable speed and are also compound wound—that is, compounded so as to embody the characteristics of the two other general types. The constant speed motors under normal conditions give practically constant speed for all torques and horsepower capacities within the range of the motors. The synchronous alternating current motors in this group give absolutely constant speed if the cycles or frequencies of current in the circuit upon which they operate remain constant. Continuous current constant speed motors are shunt wound and are usually known by that designation. The alternating current motors in this class, besides being of the synchronous type, are also of the induction type and may be either single phase or polyphase. The induction motor with its absence of commutator has many special advantages and recommendations. The single phase induction motors, included in the figures presented, have generally been built only in the smaller sizes and for operation upon lighting circuits, where the effect of sudden calling for current is not likely to have much if any effect upon the steadiness of the light. When larger induction motors are required, or a large number of small ones, power work is usually done on separate polyphase circuits. One of the difficulties in connection with synchronous motors has been that of making them self-starting, and on account of the low torque developed and the large current taken from the line they have not generally been built of late, although they have been known in the art for several years. The variable speed motor gives automatically great variation in speed for the different torques and horsepower output required of it, and has been found specially suited for work requiring frequent startings and stoppings, such as that in connection with elevators, etc. The compound type of motor is more applicable to work requiring heavy starting torque or frequent startings and reversals, and also for operation at fairly constant speed for great lengths of time. Among the classes of work that may be specified for such motors are the operation of printing presses, machine tools, planers, shapers, etc., where reciprocating motion is desired, the motor being particularly useful in holding back the rush of current from the circuit at the moment of reversal, when the torque required is at a maximum.

During the past few years electric motors of both the alternating and direct or continuous current type have been used to a considerable extent in iron and steel mills and their auxiliary apparatus, and more lately for some of the heaviest operations. Such work includes hoisting, hauling, shears, punches, saws, cross rolls and other rolls, roller beds for slabs, ingots, and blooms, apparatus for pouring steel, horizontal charging machinery for open hearth furnaces, etc. The variable speed motors are used universally for cranes and hauling as well as for the screwing down rolls, charging machinery and the smaller reversible roller beds, while the compound type of motor is also used for the larger roller beds, and for those where the reversals take place less frequently, as well as for the larger saws, cross and straightening rolls, punches, shears, etc. Some idea of the heavy nature of the work now included is afforded by the fact that 1,200 horsepower compound motors were installed recently for the Phoenix Mills to operate the reversing rolls, while two 1,500 horsepower compound wound motors, operating at 100 revolutions per minute and suitable for 25 per cent increase in speed, were ininstalled in the Edgar Thomson Works for rolling rails. A 1,500 horsepower motor was also installed in the Pittsburg Electric Works to drive blooming mills. At one plant in Germany the electrical capacity is of not less than 10,000 horsepower, and the rolls are driven at 120 revolutions per minute, the speed being attained in less than four seconds from the time of starting. The roller train consists of 4 housing frames with rolls of an average diameter of about 29½ inches, turning out blooms, steel rails, and I-beams to a maximum of 17.7 inches in height. These mills have also been turning out blooms from blocks of 2 tons, as well as I-beams 9½ inches high and 164 feet long, and I-beams 13¾ inches high and 82 feet long. In mining operations, partly for deep and speedy hoisting work, motors of equally large capacity have been successfully installed and are now in operation.

Altogether the most remarkable application of electric power in any class of work is that afforded by the new steel works at Gary, Ind., where all the machinery is being installed to be driven electrically, while the gases from the blast furnaces furnish the prime motive power for the operation of the generators. The large rail mill is driven by 3-phase induction motors, ranging in capacity from 2,000 to 6,000 horsepower, attached to the main rolls. These are altogether the largest electric motors in the world. These motors are reversible and are specially controlled, and, being subjected to sudden heavy overloads, each motor is provided with a heavy fly wheel, which, with the system of control, stores up energy when running normally and returns it to the rolls when subjected to heavy overload. Each motor can sustain an overload of 50 per cent for one hour, so that each of three of the motors which has a normal rating of 6,000 horsepower can deliver not less than 9,000 horsepower for one hour if called upon to do

so. In controlling these motors for such extremely heavy and trying service a master controller is used, upon which the main line oil switch can be opened or closed, the reversing switch be thrown in either position, or the resistance cut in and out of the rotor circuit in successive steps by means of electrically operated switches or contactors. Special precautions have been taken to insure the automatic protection of the controller system. It is impossible to operate the reversing switch unless the main line switch has been previously opened, and if the main line switch has been opened by the overload trip, it can not be closed without first bringing the controller to the off position. With regard to the special arrangement of the fly wheel in restoring energy to the motor, so-called "slip relays" are provided, in which the actuating coil carries the current to the motor. Whenever the motors are subjected to overloads the slip relays operate, cutting a small portion of the resistance into each phase of the rotor circuit, causing the motor to slow down gradually and the fly wheel to give up a portion of its energy. When the load is taken off the motor, the reverse operation takes place and the motor speeds up, returning the energy to the fly wheel.

Another large field of application of power motors is exemplified by printing offices, where not only the presses but a large number of auxiliary appliances are thus driven. The most conspicuous example of the kind in the United States is afforded by the Government Printing Office in Washington, where about 700 motors, varying in size from one-sixth of 1 to 100 horsepower, have already been utilized for the operation of the two-revolution presses, job presses, stitching machines, shaving and beveling machines, electrotype finishing apparatus, card routing machines, molding presses, and a host of other apparatus required in the processes of the printing art. Mr. W. H. Tapley, the electrician of the establishment, in discussing the equipment, has remarked: "The advantage to be gained from changing over from belted steam driving to individual electric motor for printing-press work is not alone in power saved, but better grade of work, less spoiled sheets, cleaner, healthier rooms for employees, less repairs to machinery, and most of all, an increased product without a corresponding decrease in value of the presses by running at too high speed. There has never been a hitch in the motive power; not a motor has given out. In fact, such a freedom from interruption of power has never been known in the history of the office."

A new type of small motor, which has come into considerable use since the last report for industrial motive-power purposes, is that known generically as the "interpole," which, while essentially a variable-speed motor, can also be used for constant speed work. It is manufactured specially for driving machine tools, pumps, woodworking machinery, laundry machinery, and similar classes of apparatus, whether directly connected or in belted groups. These motors operate on any 2-wire direct current lines at pressures of from 110 to 500 volts. The principle of manufacture in this motor is that of placing auxiliary field pole pieces, small as compared with the main pole pieces, and located between the latter, in the circular ring composing the field. These small pole pieces are provided with coils connected in series with each other and in series with the armature coils, and are so proportioned and arranged as to give the proper field for commutation. This construction enables the brushes to be placed equidistant between the poles; and the motor is capable of reversing its direction of rotation without detriment; and commutation in either direction of rotation takes place without sparking, whether the motor is running with variable load or at variable speed. Since the main current flows through the auxiliary field, weakening of the commutation fringe by an increased load is prevented, and the auxiliary poles produce the compensatory field of commutation independently of the main fields, which with increasing number of revolutions of the armature must be correspondingly weakened. The effect of the auxiliary pole is also independent of the direction of the rotation of the armature, because if the latter is reversed the current in the auxiliary field coils is also reversed. The absence of sparking is a great desideratum, especially where high voltages are employed, and it is this fact which has pointed to the adoption of the motors of the inter-pole type for direct current traction at higher voltages than have been employed hitherto in America. The ordinary direct current railway motor operates on a potential of 500 to 600 volts, whereas the inter-pole types can be employed up to 1,200 or 1,500. In the meantime a large number have already gone into use in mills and factories and machine shops.

The development of the electric railway field has provided, as the statistics show, an extraordinarily large and profitable opportunity to the manufacturers of street railway motors. Strange as it may appear, however, the production of this class of apparatus is confined in reality to three or four factories, and the amount of work done by one of these is relatively insignificant. There is, however, a large class of kindred work devoted to the requirements of mining, for which a considerable number of small electric locomotives are constructed annually. But even this did not materially enlarge the area of manufacture, so that at the most there are not ten factories where street railway motors and electric locomotive motors are built, although the value amounts to almost $5,000,000 a year. Whether the centers of production will remain thus limited in number as the conversion of steam railroads to electrical operation advances, presents an interesting industrial problem, especially as it has been the practice of many steam railway systems to build their own

locomotives; and should they continue to do this the creation or enlargement of the shops of electrical manufacturers devoted to this class of work would necessarily be checked. In the modern period embracing especially the electrical régime, namely, from 1890 up to 1902, the number of the street cars had increased in this country, as shown by the census figures, from 32,000 to 66,000. Not only has the number of cars increased, but the carrying capacity has increased, necessitating heavier equipment for the motor cars, and involving in a great many instances the use of four motors instead of the two that were standard in the earlier types of cars. The extreme exemplification of this tendency is found naturally on the interurban roads, and on the elevated and subway systems of the large cities. On large interurban systems it is not unusual to find cars 60 feet in length, weighing from 40 to 60 tons, and four-motor equipments may be said to be universal. To take one district as typical, it may be noted that while 75-horsepower motors are a standard type on the interurban railways of Ohio, the cars of the Lake Shore Electric System have each four 85-horsepower motors, while those of the Scioto Valley have gone so far as to adopt 100-horsepower motors. On the Interborough Subway System in New York, where the express trains have a maximum speed of 45 miles an hour, the motor cars carry two motors of 200 horsepower each, both motors mounted on the same truck—that is, the motor trucks are at one end of the cars, two motors and gear to each axle, while the truck at the other end of the car is a trailer and carries no motive power equipment. These cars, whether built of wood or of steel, are 51 feet long, with seating capacity for 52 passengers.

The latest development in the field of street railway motor construction embraced within the period of this report is the resort to alternating current with the single phase motor, or with motors of this type which can be operated both by the direct current and the alternating current, thus enabling them to fulfill more nicely the best conditions of operation at slow speed and low voltage within city limits, and high speed and high voltage in suburban and rural districts of the same system. The advances in this field have been very rapid, and to such a degree that while a number of street railways have been equipped with this style of apparatus, the New York, New Haven, and Hartford Railroad has gone further and has installed it for use on its first electric zone, having New York as the terminus or center. One of the latest and best exemplifications of single phase motor work is furnished by the Pittsburg and Butler Railway, with a circuit distance of not less than 40 miles, with heavy grades involving an average rise of 8.5 per cent continuously in lengths of 1,100 feet, and with several 7-degree curves, over which grades and curves a schedule speed of 25 miles an hour is maintained. The single phase cars of this road are each provided with four 100-horsepower motors of the compensated type, designed for using both direct and alternating current, so that while using the direct current within the city limits of Pittsburg and Butler, they "let themselves out," so to speak, with the alternating current on the intervening stretch. In these motors the field coils are placed in slots in the cylindrical laminated pole structure, and the compensating coils are distributed over the total pole area. Thus the compensating coils are in a position to neutralize effectively the magneto-motive force of the armature current, while the field coils are in proper mechanical position to allow of the best production of magnetization in the projecting field poles. The field coils of each motor are connected electrically in series, and this connection is not changed at any stage of the operation. The four motors are operated two in parallel, by two in series, for alternating current, while they are connected permanently two in series for direct current operation. Each car is provided with a frame-like skeleton pantagraph type of overhead trolley for picking up the alternating current, and with two ordinary wheel trolleys for direct current work.

In main line operation, such as that involved in the system of the New York, New Haven, and Hartford Railroad for the section between New York and Stamford, Conn., a much heavier type of single phase motor equipment has been required. The total distance is 33 miles, and between the New York suburb of Woodlawn and Stamford the road is equipped with single phase alternating current locomotives taking current from an overhead line. For this electrification 35 locomotives have been ordered. Each locomotive is furnished with 4 motors, each of 250 horsepower nominal capacity. These are of the gearless type and are wound for a normal speed of 225 revolutions per minute. They are connected permanently in pairs and require about 450 volts at the terminals on alternating current and 550 volts on direct current. The frame of each motor is split horizontally, so that it can be removed in halves in order to give access to the interior. In the floor of the cab is an air conduit, from which air is pumped to each motor in such a way as to keep it clean and cool, and this method of cooling enhances the capacity of the motor to such an extent that the rating at continuous operation is almost as good as at the one-hour rating.

On the direct-current part of the line current is taken from a third-rail system with overhead sections at short cross-overs, with the four shoes on each side of the locomotive arranged in pairs of two each. These contact shoes for direct current are ingeniously contrived to work on both forms of third rail, namely, that in which the shoe runs on top of the rail and that in which it makes an underneath or upward contact. The locomotive is also provided with a pantagraph low-tension overhead trolley, and for connecting with

the alternating current has two pantagraph type, high tension bow trolleys. Each trolley has a sufficient capacity to carry the total line current under average conditions, but two are provided to insure reserve safety capacity. For alternating current operation 11,000 volts are applied directly to the overhead line, carried by steel bridges over the track, and two step-down transformers on the car lower this pressure to the 450 volts required for the operation of the motors. Each of these locomotives handles a 200-ton train in local service on a schedule of 26 miles, with stops averaging 2 miles apart, and in order to maintain this average speed the maximum speed is about 45 miles. One locomotive is able to handle a 250-ton train on through service—that is, with infrequent stops—while for heavier trains it is the practice to couple two locomotives together and operate them in multiple.

The New York Central and Hudson River Railroad has equipped its New York terminal for operation with electric motors for a distance of not less than 34 miles out on the main line from the Grand Central station to Croton, and for 24 miles out on the Harlem division. At the entrance to this electric zone all steam locomotives are dropped, so far as passenger and mail traffic is concerned, and these trains are handled by electric locomotives of the heavy high speed express type, and in the suburban service by individual motor cars. The first contract was placed for not less than 50 electric locomotives, each of which is capable of making regularly in forty-four minutes without a stop the trip from the Grand Central station to Croton, a distance of 34 miles, with a total train weight of 435 tons. The heaviest of these through trains, weighing 875 tons, is drawn by two of the locomotives at a maximum speed of from 60 to 65 miles an hour, but recently upon test attaining over 80 miles. The locomotive has, broadly, the main lines of the steam locomotive and has four driving axles, on each of which is mounted the armature of a direct current electric motor of 550 horsepower, so that the total rated capacity of the locomotive as a unit is 2,200 horsepower, although for short periods considerably greater power may be developed, making it far more powerful than the largest steam locomotives now in existence. The weight of the locomotive is 97 tons. It has eight driving wheels and four truck wheels, a driving-wheel base of 13 feet, and a total wheel base of 27 feet, the driving wheels being 44 inches and the wheels of the engine truck 36 inches. The maximum tractive drawbar pull is 34,000 pounds, and the tractive pull per ton of engine weight is 330 pounds. The length over the buffer platform is 37 feet, the extreme width 10 feet, the height to the top of the cab 14 feet 4 inches, and the diameter of the driving axles 8½ inches. The voltage of current supplied is 600 volts and the normal full-load current is 3,050 amperes.

These motors mark a distinct advance in electric locomotive construction and have the armature built directly upon the axles. The advantage of direct application of power to the driving axles is thus secured, avoiding the losses in gear and pinion which are encountered in ordinary railway motors employed in street railway work, which have a single reduction between the armature and the car axle. There are only two pole pieces, which are thus practically part of the truck frame, and have flat vertical faces. There is no necessity, therefore, for maintaining a rigid alignment between the field and the armature, and the armature can have a large free vertical movement without danger of striking the pole pieces. The larger part of the weight of the motor, consisting of its field structure and frame, is carried upon the journal box springs outside of the driving wheels. The dead weight on each driving axle is practically the same as on an ordinary steam locomotive, and is said to be about 10 per cent less than that on the heaviest types, while in addition there is no unbalanced weight to produce vibration, which is injurious to track and roadbed construction. The main frame of the locomotive is of cast steel and the field poles and windings are arranged in tandem, the end pole pieces being cast as part of the end frames and the double pole pieces between the armatures being carried by heavy steel transoms bolted to the side frame, and forming part of the magnetic circuit as well as cross braces for the truck. The field coils are wound upon metal spools which are bolted upon the pole pieces. The superstructure to the motors and their truck frame consists of a central cab for the operator or motorman, containing the multiple unit control system, engineer's valves for the air brake system, and the switches and valves for sanding the track, whistling, bell ringing, etc. In this cab is also placed an electric motor driven air compressor, which is automatically cut in and out of circuit when the air pressure falls below 125 pounds or exceeds 135 pounds.

Current is carried from a third rail placed alongside the track by means of multiple-contact, spring-actuated, third-rail shoes, the support of these shoes being carried on channel irons attached to the journal box. Four of these shoes are placed on each side of the locomotive. In the yards at the terminal the large number of switches and crossings necessitates an overhead construction in places, and additional contacts, somewhat after the trolley system, are therefore mounted on the top of the locomotive for collecting current when the locomotive is passing these points. Another type of third-rail shoe, so hooded and protected as not to be dangerous to life nor exposed to accidental contact with falling metal of any kind, has been devised by engineers of the system.

For the enormous suburban traffic handled over the New York Central lines the company has built an initial equipment of 125 steel motor cars, the suburban traffic being brought into the Grand Central station at one level and the heavy traffic with the electric locomotives at another level. These cars are made up into trains of the motor cars and trail cars, as are those on the New York Subway and on the modern electric elevated roads of New York, Chicago, Boston, etc. During the period of initial operation under the electrical régime these cars are coupled up for part of their run for haulage behind steam locomotives. The motor equipment of these 125 motor cars comprises two motors for each car. These machines are rated at 200 horsepower each and both motors are mounted on the same truck. They are operated at a potential of 650 volts, although this can be carried up to 750 volts. The motor trucks are all steel, with 36-inch wheels on the motor trucks and 33-inch wheels on the trailer trucks. The total weight of the motor car loaded is 111,560 pounds, and the weight of the motor per truck is 12,400 pounds. It may be of interest to note that a steam train of the average suburban type with locomotive and six loaded cars weighs 700,160 pounds, while the electric train of equal seating capacity with four motor cars and two trailers weighs 621,360 pounds, or a difference of 39.4 tons in favor of the electric train.

Transformers.—Table 6 shows the production of transformers reported in 1900 and 1905.

TABLE 6.—TRANSFORMERS—NUMBER, HORSEPOWER, AND VALUE: 1905 AND 1900.

STATE.	TOTAL.			50 KILOWATT AND OVER.			UNDER 50 KILOWATT.		
	Number.	Horsepower.	Value.	Number.	Horsepower.	Value.	Number.	Horsepower.	Value.
United States, 1905	66,698	970,908	$4,468,567	3,387	504,009	$1,176,360	63,311	466,899	$3,292,207
1900	36,513	407,451	[1] 2,962,871	(2)	(2)	(2)	(2)	(2)	(2)
States, 1905:									
Illinois	4,628	10,221	31,694	(3)	(3)	(3)	4,628	10,221	31,694
Indiana	4,318	21,190	172,460	25	1,556	9,580	4,293	19,634	162,880
Ohio	1,767	1,082	36,759	(3)	(3)	(3)	1,767	1,082	36,759
All other states	55,985	938,415	4,227,654	[4] 3,362	[4] 502,453	[4] 1,166,780	[5] 52,623	[5] 435,962	[5] 3,060,874

[1] Includes transformers to the value of $2,700, for which number and horsepower were not reported.
[2] Not reported separately.
[3] Included in "all other states."
[4] Includes states as follows: Illinois, Massachusetts, Missouri, New Jersey, New York, Ohio, Pennsylvania, and Wisconsin.
[5] Includes states as follows: Massachusetts, Missouri, New Hampshire, New Jersey, and Pennsylvania.

The production of transformers has nearly doubled from one census to the other, the value having risen from $2,962,871 to $4,468,567, while the total capacity has increased from 407,451 to 970,908 horsepower, and the number from 36,513 to 66,698. These statistics are eloquent testimony to the growing use of alternating current for lighting and power purposes, particularly for lighting in large suburban and semirural districts and for substation purposes in the large railway systems and in most of the large cities. So far as lighting is concerned, the cities of the first class which began originally with lighting systems based on direct current supplied to their customers are still dependent on that type of current, but the operating companies have adopted generation by means of alternating current dynamos, sending out their current at high voltage to substations where it is lowered in pressure by transformers and converted for delivery to the consumption mains. It will be seen from the statistics that more than half the capacity of the transformers manufactured in the census year, namely, 504,009 horsepower, was comprised in transformers of 50 kilowatt capacity and upward, giving an average of nearly 150 horsepower. The effect of size on price is seen in the fact that these larger transformers were returned as valued at $1,176,360, or slightly over $2 per horsepower, a low figure as compared with the price of those under 50 kilowatt capacity. In this latter class, of which there were 63,311, the total capacity was reported as 466,899 horsepower, valued at $3,292,207, or about $7 per horsepower. It is also to be noticed that the average size of these smaller transformers was under 10 horsepower. Taking the figures as a total, it seems that the average value of all transformers in 1905 was about $4.50 per horsepower; whereas in the previous census year, 1900, the average value returned for the total output was slightly over $7.25 per horsepower. This fact emphasizes the effect of the larger size in reducing the cost to the purchaser, but the general reduction is not so clearly determined, for the reason that in the earlier census a differentiation into the two classes was not made between large and small transformers.

As already remarked, these statistics indicate a large production and the important place filled by the transformer in the arts of furnishing light, power, and traction. There are no figures available for the production in the intervening years between 1900 and 1905, and no attempt is made in the present report to distinguish between transformers employed for lighting stations and for power for electric railways, as many of them serve both purposes at the same time. But it is significant that the capacity of the output reported in 1905, namely,

970,908 horsepower, was much larger than the total capacity of the transformers manufactured in 1900. If those of larger capacity than 50 kilowatts be excluded in 1905—as that class would embrace all of those devoted to traction purposes, while probably none in the smaller class was so employed—it is to be noted that in 1905 the capacity was not less than 466,889 horsepower, while, expressed in the same unit of power, the total capacity of all transformers five years before was only 407,451 horsepower. A little further light on this relation as to the use between the larger and the smaller transformers is also given by the Census report of 1902 on lighting plants, where it is shown that the transformers in substations as a part of the central station distributing system had a total capacity of 419,367 horsepower, or nearly one-half as much capacity as all those manufactured in 1905. All the evidence, therefore, that can be brought to bear upon the subject shows that the electric lighting art claims a very large proportion of the transformers manufactured, both as to capacity and number.

The smaller transformers are mainly of the same type as those which were included in the report of 1900 with improvements rendering them more strictly weatherproof; while in the larger sizes it has become the practice to keep them cool by means of immersing the working parts in oil, so that the transformer is virtually an oil tank, containing the primary and secondary coils. In some instances the cooling is also effected by means of air, for which purpose forced draft is occasionally resorted to. The oil is found a better heat conducting medium than air, and a transformer will show a much lower temperature with oil cooling than without. Hence its use is very general through a large range of sizes.

Owing to the development of alternating current power transmission, which has rendered desirable and necessary a corresponding increase in both the kilowatt capacity and the voltage pressure of the transformer units, some of the latest transformers are of sizes that a few years ago would have been considered gigantic. These transformers are used both for stepping-up the electromotive force to a value suitable for transmission economically, and for stepping it down again to safe pressures at the receiving consumption ends. There are several types of these larger transformers. One type, which may be presented as typical, has the oil within it set into continuous circulation by the cooling effect of water coils placed in the top of the transformer tank, to which the oil transfers the heat generated in the transformer. The oil rises through ducts provided in the iron and copper structure of the transformer, giving up its heat to the water coils and descending between the transformer and the wall of the tank. The entire circulation of oil thus effected secures a high cooling efficiency of the oil in the transformer. The largest units of this type built up to the date of the figures of this report were 2,670 kilowatt capacity each, transforming 25-cycle single phase current from 10,000 or 12,000 volts up to 50,000 or 60,000 volts in connection with the utilization of Niagara Falls. A much larger type of transformer, however, is that in which the use of a pump and reservoir in the oil circulation system gives a better control of oil circulation in the transformer so that the heat, which can be easily held down to safe and economical limits of temperature, rises for continuous full load operation; while with sufficient capacity in the oil and water pumps such transformers can carry extreme overloads in the hour of emergency. The oil is circulated by pressure and the water by suction, so that any leak developed in the circulation system does not result in the admixture of the water and the oil. The largest transformers of this type have been those built for the Great Northern Power Company in connection with the development of the St. Louis river in the vicinity of Duluth and have a capacity of not less than 7,500 kilowatts on 25-cycle 3-phase current, and can actually carry 10,000 kilowatts. In these huge transformers the low tension windings are adapted for 6,600 or 13,200 volts, while the high tension windings will withstand 30,000 or 60,000 volts. These transformers have the exterior dimensions as follows: 14 feet 10 inches high, 14 feet long, and 5 feet 10 inches wide.

Switchboards.—Table 7 presents the statistics of switchboards as reported in 1900 and 1905.

TABLE 7.—*Switchboards for light and power—value: 1905 and 1900.*

STATE.	Value.
United States, 1905	$3,766,044
1900	1,846,624
States, 1905:	
California	27,749
Colorado	15,510
Illinois	244,590
Indiana	12,700
Massachusetts	468,689
Minnesota	46,250
Missouri	127,500
New York	1,373,366
Ohio	54,056
Pennsylvania	1,157,027
Wisconsin	11,075
All other states [1]	227,532

[1] Includes states as follows: Connecticut, Delaware, District of Columbia, Georgia, Louisiana, Maine, Maryland, Michigan, Nebraska, New Jersey, North Carolina, Oregon, Rhode Island, Texas, Washington, and West Virginia.

This section of the report is devoted specifically to switchboards intended for electric light and power and electric railway work. It will be understood that there is no system of centralized electrical supply to-day that does not depend upon a switchboard for the manipulation of the circuits—that is, for the connection of the sources of supply with the customer; but this grouping does not include telegraphic or telephonic switchboards, which are included in their respective categories and which are employed for the work of placing the operators or the persons communicating in immediate and direct relationship with each other. With

switchboards for light and power the ultimate consumer is not a factor of the problem, whereas in telegraph and telephone boards every circuit of the individual operator or of the individual telephone subscriber must be led to the board in order to permit of the instantaneous and direct interconnection, and this may be said to constitute the great line of differentiation.

As will be seen from the statistics, the value of the lighting and power switchboards has risen from $1,846,624 in 1900 to $3,766,044 in 1905. In other words, the product has almost doubled in the period. This fact, however, does not emphasize fully the importance that the switchboard has assumed in modern installations, for the reason that the board has ceased to be a unit and has in a general way become subdivided, so that in large plants it often extends over several floors, its various parts and mechanisms being placed one above the other. This kind of construction has been called for by the prevailing method of generating electrical energy in the form of 2-phase and 3-phase alternating current for transmission at high voltages to substations, where it is converted into direct current, and there, through the intermediary of the subswitchboards, passes out to the consumption circuits. In the Government Printing Office at Washington is an excellent type of the old style of direct current switchboard, built of Tennessee marble and having a total length of over 83 feet. The new section of this board, with a length of 34 feet, consists of two generator panels and seven feeder panels, carrying not less than 25,000 pounds of copper on its circuits to receive and distribute the current from the generators. This board, which represents an expenditure of several thousand dollars, is bound by handsome, heavy copper molding, with iron framework and angle iron braces, cable carriers, etc., and is heavily coated with asphalt paint for insulation. It will be noted that marble is used, and this, with slate, is the prevalent material. Wood, which was at one time universally used even on boards for currents of high voltage, is now severely discriminated against in the rules of the National Electrical Code.

A recent type of the "straightaway" switchboard for alternating current purposes is furnished in the equipment of the Holyoke (Mass.) Water Power Company, where the long board, all on one floor, is made up of 12 panels, of which 6 are generators, 2 are exciters, 3 are feeders, and 1 is a regulator, while 3 are left blank for extension. The 6 panels equipped with the apparatus for controlling the generators are furnished with push-button switches for the control of the water-wheel governors, the plant being driven by water turbines as well as by steam turbines. By means of this push-button system of control the switchboard attendant is enabled to raise or lower the speed of the water wheel, and hence that of the alternating generator, which is to be thrown into the supply system in parallel, by merely placing his finger on one or both of the push buttons and without removing his eyes from the synchronizing lamp that indicates the proper moment for completing the operation. A more brilliant and striking exemplification of the push-button control in switchboard practice is afforded by the "dummy" type of board which has been installed in several plants and is to be found in some of the largest stations, such as those of the Manhattan and Interborough Railway systems in New York city. The switchboard proper is associated with a control board with which every alternating generator switch, selector switch, group switch, and feeder switch upon the main floor is represented by a small switch connected into a control circuit receiving its supply of electrical energy at 110 volts from a small motor generator set and storage battery. The motors which actuate the large oil switches upon the main floor of the power house are driven by this 110-volt control current, and thus in the hands of the operator the control switches make or break the relatively feeble control currents, these in turn, after the manner of relays, closing or opening the switches in the main power circuits. The control switches are grouped upon the control bench board in conjunction with dummy bus bars and other connections, so that the whole constitutes at all times a correct diagram of existing connections of the main power switches. Thus every time the operator changes a connection by opening or closing one of the main switches, he changes necessarily the diagram before him on the dummy board so that it represents the new conditions that have been established in connection with each control switch. Small bull's-eye lamps are used like signals—one colored red to indicate that the corresponding main switch is closed, and the other green to indicate that it is open. These little lamps are lighted when the moving part of the main switch reaches approximately the end of its travel. If for any reason the movement of the control switch should fail to actuate the main switch, the indicating lamps would not be lighted. The control board is divided into two parts; one for the connection of the alternators to the bus bars, and the other for the connection of the feeders to the bus bars. Such arrangements have simplified and assisted greatly the work of the switchboard attendant, but can not be said to have lessened in any degree the length, or size, or complications of the main switchboard system.

A good idea of what may be called the distributed switchboard may be gained from the electrical control equipment installed in the Waterside stations of the New York Edison Company, where, on the first floor level, adjacent to the steam turbine room in Plant No. 2 are located the exciter units and associated controlling apparatus, a booster, a compensator, and two end-cell switches for the storage batteries. On

the first mezzanine floor are the main and auxiliary bus bars, encased in compartments of brick wall and concrete cement, the bus having wired glass doors in front and at the back, where the cables are attached through disconnecting switches. The second mezzanine gallery contains the selector oil switches by which the feeder or generator cables are connected to the copper bus bars or "busses." On the third mezzanine gallery are the potential transformers, whose connections are brought down from the gallery above through disconnecting switches. On the fourth mezzanine floor are the oil switches, from which are led out through series transformers the high tension feeders to the underground mains. On the fifth mezzanine gallery are placed racks to carry the control wires to the operating boards. Hence it will be seen that the switchboard or switching mechanism continues through several floors or tiers of the building and presents a front to the dynamo room far exceeding in height that of an ordinary dwelling house. The view of such a lofty switchboard as seen in the Waterside Plant No. 1 is indeed most impressive, and gives a vivid idea of the enormous equipment and expense necessary for merely handling the currents generated in such enormous volume by the large power houses.

At one time the switchboard industry was carried on by a large number of manufacturers and required little else than skillful working in hard wood. At the present time switchboards, such as those described, with their huge slabs of slate or marble, and their framework of copper, iron, and steel, involve many problems of intercommunication and of apparatus adjustment. The result is that the larger electrical manufacturing companies have virtually taken over the construction of the switchboards for the plants which they equip, and have made a business also of supplying many of the indicating and recording instruments placed upon the front of the boards.

Batteries.—Table 8 presents statistics of storage and primary batteries, parts, and supplies for 1900 and 1905.

TABLE 8.—BATTERIES, STORAGE AND PRIMARY—VALUE: 1905 AND 1900.

STATE.	Aggregate value.	STORAGE.				PRIMARY.					
		Total value.	Weight of plates (pounds).	Value.	Parts and supplies (value).	Total value.	Liquid.[1]		Dry.		Parts and supplies (value).
							Number.	Value.	Number.	Value.	
United States, 1905	$4,243,893	$2,645,749	16,113,072	$1,569,371	$1,076,378	$1,598,144	1,734,801	$515,530	4,888,361	$513,026	$569,588
1900	3,679,045	2,559,601	(2)	2,559,601	(3)	1,119,444	708,077	[4] 571,370	1,946,688	316,013	232,061
States, 1905:											
Illinois	257,897	257,897	446,181	137,643	120,254	(5)	...	...	(5)	(5)	(5)
New Jersey	259,240	(5)	(5)	(5)	(5)	259,240	356,840	259,240	(5)	(5)	(5)
New York	646,703	304,947	691,375	304,947	(5)	341,756	121,166	69,531	1,582,142	178,611	93,614
Ohio	26,982	26,982	141,429	18,675	8,307	(5)	(5)	(5)	(5)	(5)	...
All other states	3,053,071	2,055,923	[6] 14,834,087	[6] 1,108,106	[7] 947,817	997,148	[8] 1,256,795	[8] 186,759	[9] 3,306,219	[9] 334,415	[10] 475,974

[1] Includes 128 testing batteries with a value of $12,715 in 1905; and 1,200 with a value of $1,350 in 1900.
[2] Not reported.
[3] Not reported separately.
[4] Includes batteries to the value of $1,500 for which number was not reported.
[5] Included in "all other states."
[6] Includes states as follows: California, Maryland, New Jersey, Pennsylvania, and Wisconsin.
[7] Includes states as follows: Missouri, New Jersey, New York, and Pennsylvania.
[8] Includes states as follows: California, Connecticut, Maryland, Massachusetts, Michigan, Ohio, Oregon, Pennsylvania, and Rhode Island.
[9] Includes states as follows: California, Connecticut, Illinois, New Jersey, Ohio, Pennsylvania, Rhode Island, and Texas.
[10] Includes states as follows: Connecticut, Illinois, Massachusetts, New Jersey, and Pennsylvania.

The returns from manufacturers as to the production of primary and storage batteries, parts, and supplies give a total of $4,243,893, as compared with $3,679,045 at the previous census. Of this total in 1905, storage batteries contributed $2,645,749 and primary batteries $1,598,144. As a matter of fact, the total that should be credited to this field would be larger if it were possible to include within it several items which are necessarily thrown into "all other products." Both storage and primary batteries consist of various elements, which are not always distinguishable or sold together as a unit by the same manufacturer, and yet it is not until these are brought together that a complete cell is constituted. In fact, many of the parts and supplies lie outside the electrical field. For example, a storage battery complete consists of lead plates, the separators used between them, the sulphuric acid solution into which the plates are immersed, and the containing jar of glass, porcelain, rubber, etc. The primary battery in like manner consists of various elements, such as the jars, zinc, copper, carbon, sulphuric acid, caustic soda, bichromate of potassium, according to the nature of the cell, and on the constant renewals of these the efficiency and life of the cell depends. There has undoubtedly been a very large increase in the production and use of storage batteries since the census of 1900, but it is not revealed to any extent by the relative figures here presented. It is true that in the year 1900 there was great activity in the department of storage battery automobiles, giving a stimulus to the production of batteries for that purpose; but while the demand in that field has not fulfilled expectations it has grown enormously in other branches of the electrical arts, and to meet

it there have been extensions of the factories devoted to this line of manufacture.

The most extensive use of storage batteries, as already indicated, is in connection with central station lighting plants and electric railways. In such a system, for example, as that of the New York Edison Company storage batteries are to be found not only at the substations but also at the generating plant. In the new Waterside Station No. 2 of that company there are two large batteries installed in the basement, one of 140 cells and the other of 150 cells. One of these is kept on the exciting system for the excitation of the alternating current generators and the other is at all times available for the local distributing system. In like manner, for the work of the New York Central Railroad, the electric storage battery equipment is the largest of its kind in the world. It not only takes care of the fluctuations in the load, but is sufficiently large to operate the entire system under normal conditions for a period of one hour, in case of failure of the generating apparatus. Five of the batteries have an output of from 2,000 to 2,500 amperes for one hour, and the three others have outputs of 3,000, 3,750, and 4,020 amperes, respectively. The batteries are located in buildings adjoining the substations, and are operated in connection with the booster and switching apparatus which occupies the substations. The discharge from the battery is governed by a carbon regulator working in connection with the exciters and boosters, the aim and object of which is to make the battery discharge when there is a heavy demand for current from the line and to charge when the demand is so light that the generating plant can economically put its surplus into this reserve.

The use of large storage batteries, employed to improve the reliability of the railway systems as well as to reduce the operating costs, is well illustrated by the interurban roads of Indiana and Ohio. They have usually been installed with enough lead plates to meet the demands of the load at the time of initial equipment. The large tanks which contain the electrolyte in which the plates are immersed, the boosters, and the other accessories are, however, often considerably larger, so that as the load grows, plates can be added to the battery, and the additional work can be adequately taken care of. In Ohio there are 25 such installations and at least 16 in Indiana, making a total of over 40 large storage battery equipments in these two states in interurban railway work alone. They aggregate 9,376 kilowatts at a one-hour rate of discharge, and when increased to their ultimate energy capacity will have an aggregate of 11,710 kilowatt hours. The function of the battery in such work is indicated by the example of the Northern Ohio Traction and Light Company, which has a battery of 195 kilowatts initial capacity and 288 kilowatts ultimate capacity. Before the installation of this equipment it was necessary at all times to operate two 250 kilowatt generators to carry the load and operate the cars. After the battery was installed it was found feasible to operate the load a large part of the time with only one generator, resulting in a large saving of coal. In like manner another battery of 140 kilowatts has been operated on the Ravenna division to assist in maintaining a steady electrical pressure on the line, so that whereas the electromotive force formerly fluctuated between 100 and 500 volts, it is now maintained at a minimum of 400 volts with much greater efficiency in the operation of the cars. The Dayton and Northern Traction Company was a pioneer in Ohio in the use of the storage battery for interurban work and at two substations has batteries, each of which consists of 260 kilowatts capacity. This road was especially laid out with a view to the use of the battery as an auxiliary, and was therefore enabled to install smaller generators and rotary converters than would have been possible had the battery been omitted.

The storage batteries mentioned above are almost wholly of the lead-lead type or those using lead or lead compound as the active material on the plates and diluted sulphuric acid as the electrolyte in which the plates are dipped or submerged. These lead batteries are made in various ways, but are of two generic types, the Faure and the Plante, the former type predominating as that in which the slower forming process of the Plante method is obviated.

A second class of storage battery little known or used is the copper-zinc or lead-zinc type, but a third class of which considerable numbers were made in the census year is that due to Edison in this country and Jungner in Sweden, in which the soluble zinc negative of the lead-zinc battery is replaced by a grid containing an insoluble metallic sponge. Caustic potash solution is employed as the electrolyte. Upon discharge the metallic sponge becomes oxidized, while the metallic oxide on the positive plate becomes reduced; on discharging the original condition is reproduced.

With his aim directed at very exacting requirements, Mr. Edison has made a large number of iron-nickel cells. The structural material of the cell is steel. The grids and cups that support the active material, the connecting and binding posts, the spacing washers, nuts, jars, and cover are all made of thin steel. In fact, the entire cell is constructed of steel, with the exception of the small amount of hard rubber used for insulating purposes. Each piece employed in the construction of the cell is plated before using with a heavy coat of nickel, which is fused to the steel by a special process, adding to the durability and finish of the cell. The active materials, consisting of specially prepared oxides of nickel and iron, are packed into very finely perforated cups or pockets in the plates, each cup or pocket being made in two sections engaging one within the

other. To preserve contact between the particles of active material at all times so as to secure the maximum electro-chemical effect, the nickel mass has been admixed with a considerable amount of graphite in the form of excessively thin flakes and the iron mass has been admixed with a small portion of mercury. These added materials act simply as insoluble conductors between the active particles. When filled with the active material these light cups are placed in suitable rectangular openings in the thin steel grid, and the whole being subjected to a very high pressure, the two sections of each cup are firmly locked together and are at the same time fastened securely into the grid, then resembling somewhat the panes of glass in a small window or the slats in a shutter. The result of this method of manufacture is a plate extremely strong mechanically yet one of unusual lightness. To the eye there is no difference between one of the plates packed with nickel oxide and one built up with the iron oxide cups. In the ordinary type of cell there are 24 of the cups in each plate, and the cell consists of 28 such plates, 14 of nickel, connected with the positive pole of the cell, and 14 of iron oxide, connected with the negative pole, each set being strung on a connecting rod, and all of them being interlocked in such a manner that each iron plate has a nickel plate on either side of it, and each nickel plate has two iron plates as neighbors, except in case of the end plates, one of which is of nickel and the other of iron. The outer surfaces of these plates are in juxtaposition, with two sheets of hard rubber serving to insulate the metal plates from contact with the sides of the containing steel jar. The iron and nickel plates are also prevented, by separators, from coming in contact, for which purpose hard rubber rods have been used. It will be understood that cells can be made with a lesser or larger area, this being simply a detail of manufacture to meet the requirements. The outer jar is made of corrugated sheet steel, having pieces of hard rubber at the bottom and ends to protect it from contact with the plates. The cover is welded to the jar, and on it are mounted two stuffing boxes through which the binding posts, fastened to the positive and negative elements of the cell, extend. There are two other small mountings on the cover. One is the separator which separates the spray from the gases when the battery is charged, thus preventing loss of potash and causing the gas to be inodorous. The other is the filler, through which the electrolyte—a 20 per cent solution of potash—can be supplied to the cell and through which distilled water may be added from time to time to maintain the level of the electrolyte, offsetting the loss by evaporation and overcharging. This filler has a water-tight cover held in place by a strong catch. Fastened to this cover is a small spring which causes it to fly open when the catch is released, but it can not be closed again without some small pressure being exerted, nor will it stay closed unless the catch is securely fastened. When the cover is in place, it is always water-tight, and the chances are minimized of leaving it open accidentally and of possible spilling of solution should the cells be severely agitated. These cells are convenient and simply assembled into trays so as to constitute a battery, wooden trays being built to hold four, five, and six cells. The connections between the cells are made by means of heavy copper wire, well nickel plated. This type of battery to the number of several thousand cells was in use at the time of the collection of these figures, but has been subjected to various improvements. One of the great difficulties encountered by Mr. Edison in the development of this battery was to preserve the contact between the nickel particles which alternately expanded and contracted during the charging and discharging operations, resulting in the gradual deterioration in the capacity of the nickel elements. Furthermore, it was found that contrary to the general expectation graphite was not absolutely insoluble to the potash solution when subjected to the effect of electrolysis. To overcome these defects, it is proposed to make the pockets of the nickel mass in the form of small perforated steel tubes in which the material will be packed under a pressure of several thousand pounds per square inch, and to substitute for the graphite, flakes of cobalt or nickel. In this way expansion of the mass is actually resisted by the tubular pocket and consequently the initial contact is indefinitely preserved. The advantages claimed for this general type of "oxygen lift" battery are its greater capacity per unit weight and its longer life, but, on the other hand, objection is made to its low electromotive force of only 1 to 1.25 volts, as compared with the 2 volts and upward of the lead-lead type.

Of late years there has been little change in the primary battery manufacturing field, the reason being that such batteries were not found suited for relatively heavy work, and that in many instances, as in telegraph offices and telephone exchanges, they have been replaced by small dynamo-electric outfits, and by storage batteries. One branch, however, in which there has been marked activity during the past five years has been that of dry batteries. These are in universal use in connection with gasoline or hydrocarbon automobiles, and almost every automobile of that type carries with it an equipment of several dry batteries. These, being under constant use and subject to accidents of various kinds, are frequently renewed, with the result that the production has been very sharply stimulated by the development of the automobile. A primary type of battery that answers many of the purposes of light power, as, for example, driving a fan motor, supplying current to an X-ray outfit, or operating railway signals, is the Edison copper oxide, which, according to Professor Carhart, has a capacity of work per unit weight greater than that of any other

battery, either primary or secondary, hitherto known. In other words, 2.2 pounds of its own weight is able to furnish an amount of electrical energy which, if converted into mechanical energy in a perfect electric motor, would be capable of lifting a pound weight 188,000 feet. In this battery the copper oxide employed is furnished in the form of a compressed slab, which with the connecting copper support serves also as the negative plate. In more recent cells of this type the device has been resorted to of reducing a superficial film of copper on the oxide slab before it is sent from the factory. This film of copper also serves to reduce the internal resistance. The other element in the battery is zinc, the solution being caustic soda.

Prof. F. B. Crocker, in a paper read in 1888 before the American Institute of Electrical Engineers on the "Possibilities and limitations of chemical generators of electricity," discussed and compared the various types of primary cells then on the market, and said that little or no progress had been made for almost a half century, but that the apparatus was at fault rather than the chemical action. He has recently directed attention, as a marked advance in the art, to the battery of Mr. F. A. Decker, of Philadelphia, which has been developed during the past two or three years, and regards it as removing the reproach against inventive ability in this field. This cell is of the two-fluid type, with zinc plates immersed in dilute sulphuric acid and graphite plates in a solution of sodium bichromate and sulphuric acid commingled. The size and number of plates employed in each cell depend upon the current required, but ordinarily there are only two or three flat zinc plates about 5½ inches wide by 9½ inches high, each weighing about 1 pound. Each zinc plate and the dilute sulphuric acid surrounding it are contained in a flat, rectangular, porous cup, made by two unglazed earthenware plates with thickened edges and diagonally strengthened ribs shaped separately in steel molds. These plates are made extra thick to prevent warping in burning, and to produce true flat surfaces and straight edges. When united the cup is ground down on each surface to such an extent that the finished walls are thin and translucent. At the same time the cup is quite strong, no breakages occurring even in automobile service. The exceeding thinness of the walls tends to reduce the internal resistance to a minimum, and the fact that these walls are true permits the graphite and the zinc plate to be placed close together with obvious effect in reduction of resistance, which by test is only 0.013 ohm for a cell with two zinc and three graphite plates and all the connections, the resistance of the plates themselves being included. The negative plates are of graphite, corrugated so as to afford large surface for the action of the depolarizing liquid, with stiffening in the thick edges and diagonal ribs. The case around the porous cups and the graphite plates is filled with the depolarizer, consisting of a solution of sodium bichromate mixed with sulphuric acid. Passing over minor details of construction and finish, it may be stated that a cell of this type under test by Professor Crocker with two zinc and three graphite plates was discharged for a period of five and a half hours at 24 amperes, the internal potential falling from 1.9 to 1.3 volts. In other words, the cell gave 126 ampere hours at an average voltage of 1.73, or 218 watt hours. The cell was then shaken to stir up the liquid and gave 24 amperes for fifty-three minutes longer. This corresponds to the conditions that would exist in electric vehicles, electric launches, or in train lighting. The total output, therefore, was 147 ampere hours at 1.684 average voltage, or 247.55 watt hours. As the complete cell weighed 16.14 pounds, including all solutions, connections, etc., the output was thus 14.7 watt hours per pound of total weight, or about twice as great as that obtained from standard types of the storage battery. The liquid constituted only about one-half of the total weight of the battery, so that with an automobile an additional quantity of solution equal to the weight of the battery could easily be carried in tanks. In this case three times as much electrical energy could be obtained with only twice the total weight. In other words, the output would be 22.5 watt hours per pound, or about three times that obtainable from a standard storage battery. The question of cost is, however, a serious one, and the weight of the zinc, sulphuric acid, and sodium bichromate required to give 1 horsepower hour in this battery—assuming all materials to be thrown away after using—would cost about 35 cents, which is admittedly high. On the other hand, the depreciation of the automobile storage battery is very high, and a close comparison would not be unfavorable to the primary type. An advantage also of this battery, as compared with those of the Edison-Lalande copper oxide type, is its voltage, namely, 1.9 initial and 1.7 average, as compared with 0.667 to 0.4. It is evident from these statements that hope is by no means abandoned in the primary battery field and that the industry has taken on a new lease of life.

Carbons.—Table 9 presents statistics for carbons for 1900 and 1905.

TABLE 9.—*Carbons—value: 1905 and 1900.*

STATE.	Total value.	Lighting (value).	Furnace (value).	Brushes, battery, and miscellaneous (value).
United States, 1905	$2,710,935	$1,050,971	$172,454	$1,487,510
1900	1,731,248	1,263,732	10,974	456,542
States, 1905:				
Ohio	2,216,639	875,544	(1)	1,341,095
All other states	494,296	[2] 175,427	[3] 172,454	[4] 146,415

[1] Included in "all other states."
[2] Includes states as follows: Illinois, Indiana, New Jersey, Oregon, Pennsylvania, and Texas
[3] Includes states as follows: Ohio and Pennsylvania.
[4] Includes states as follows: Illinois, Massachusetts, Missouri, New Jersey, New York, and Pennsylvania.

The value of all classes of carbons reported in 1905 was $2,710,935, a gain of almost $1,000,000 over the census year 1900. This gain was almost wholly in the class of "brushes, battery, and miscellaneous," there being, as a matter of fact, a falling off of over $200,000 in the department of arc lamp carbons, in which the amount was only $1,050,971 as compared with $1,263,732 at the census of 1900. Although the amount was small, there was also a very marked gain in carbons for electric furnaces, the total being $172,454 as compared with $10,974, an increase of more than fourteen-fold. Probably no other department of electrical work reported quite so high a gain.

The falling off in arc lamp carbons is not at all due to the smaller production of arc lamps, as the number of these has been steadily maintained; but whereas the old type of open arc lamp required to be supplied daily with new carbon points, the modern types of inclosed arc lamp, which have almost entirely replaced the open type, will burn for a couple of weeks without recarboning, the consumption being so much less in the semivacuum provided by the inner globe of the inclosed lamp. On the other hand, the carbons used in inclosed lamps are of special construction and cost more than the grades usually employed for open lamps, so that the decline in quantity has been to some extent made up by the increase in quality and cost.

Moreover, the past few years have seen the introduction of lamps in which a special kind of carbon stick is necessary. In the ordinary arc lamp employing plain carbons the light of the arc is a bluish white which is often condemned as disagreeable, and, with the object of securing a light which would correspond more closely in color with that of the incandescent lamp and of the gas flame, resort has been made to what are known as impregnated carbons, in which the carbon base has been mixed with metallic salts. The result is that a large number of "flaming" or "luminous" arc lamps are now upon the market and can be seen on the streets of many cities, their light being of a bright golden color. It has been claimed that such lamps can furnish at least five times the light per watt of electrical power as the inclosed arc, but one of the objections has been that the carbons have a tendency to smoke or fume. It is said that in practice it has been found impossible to increase the metallic impregnation of carbon for the flaming arcs above 6 per cent, as beyond that limit the light is no longer steady. For the positive carbon, such metals as calcium, magnesium, barium, etc., are found suitable; while for the negative carbon, metals which form acids are required, such as tungsten, chromium, and molybdenum. Suitable additions in the positive carbon also are fluorspar and magnesia, and for the negative carbons, tungstic acid and chromium fluoride. The diameter of such carbons can be increased so as to increase the life, as they are constructed in several zones or layers, with the mineral admixtures in varying proportions.

Yet another variety of lamp now coming in of the luminous arc type is the magnetite, to which reference has elsewhere been made under "arc lamps," but which may be noted here because it dispenses entirely with carbon. The negative electrode is a stick of magnetite, while the positive electrode is a block of copper.

With regard to the furnace carbons it may be said that these are of considerable size, shape, and variety, depending upon the work required of them. Reference to these in detail can be found in the standard works on electro-metallurgy and electro-chemistry, although details are not usually given of the exact method of use or the extent of consumption. Each year sees some new branch of electro-metallurgical work open up in which such carbon electrodes are used, and it has recently been noted, with regard to the production of pig iron from electric furnaces in Canada, that the consumption of carbon electrodes per ton of pig iron runs between 15 and 20 pounds to the ton, representing, it is stated, an average cost or consumption of 30 cents worth of carbon per ton of the pig metal.

The miscellaneous group of carbons, shown in Table 9, necessarily includes a large amount of other carbons of special shape employed for retort purposes, but there are two other large classes, one including the small carbon buttons and granules used for telephonic transmitters, while the other comprises the carbon brushes now used very largely for all classes of dynamos and motors and invariably for the motors used in electric railway work. Carbons are also used to some extent in electrical resistances, and these are likewise included in the miscellaneous group. In other words, the use of the carbon is universal throughout the electrical arts, ranging from tiny grains up to rods 60 inches in length and blocks well-nigh a foot in diameter.

Arc lamps and searchlights.—Table 10 shows the number and value of open and inclosed arc lamps for 1900 and 1905.

TABLE 10.—*Arc lamps—number and value: 1905 and 1900.*

STATE.	TOTAL.		OPEN.		INCLOSED.	
	Number.	Value.	Number.	Value.	Number.	Value.
United States, 1905	195,157	$1,574,422	1,748	$29,989	193,409	$1,544,433
1900	158,187	1,827,771	23,656	276,481	134,531	1,551,290
States, 1905:						
Indiana	6,372	83,068	(1)	(1)	6,372	83,068
Pennsylvania	48,058	82,965	(1)	(1)	48,058	82,965
All other states	140,727	1,408,389	[2]1,748	[2]29,989	[3]138,979	[3]1,378,400

[1] Included in "all other states."
[2] Includes states as follows: California, Illinois, Indiana, Massachusetts, Ohio, and Pennsylvania.
[3] Includes states as follows: Illinois, Massachusetts, New Jersey, New York, Ohio, Rhode Island, West Virginia, and Wisconsin.

The total production of arc lamps reported in 1905 amounted to a value of $1,574,422, or $253,349 less than for 1900. At the same time the number showed a large increase, rising from a total of 158,187 to 195,157. These lamps were divided into two groups, open and inclosed, and since the year 1900 a remarkable change has taken place in the relative importance of these two types. In this short period the production of open lamps fell from 23,656, worth $276,481, to 1,748, valued at $29,989. This number would barely take care of renewals, and hence it may be said that the open arc lamp, with which the great bulk of electric street lighting has been done for so many years, is in process of extinction and may be in a very few years obsolete. This view is corroborated by the fact that the number of inclosed lamps made in one year has risen from 134,531 in 1900 to 193,409 in 1905, and, as will be seen, the larger number has brought with it a reduction in cost. The smaller number in the year 1900 was valued at $1,551,290 as compared with $1,544,433 in 1905. The average cost per lamp is thus reduced from $11.50 each to $8, or nearly one-third. This is very convincing evidence of the popularity of the inclosed arc as compared with its predecessor.

These open and inclosed lamps are of either the direct or the alternating current type. The vogue of the inclosed type dates back to 1894, although experiments upon it began several years previously. The principal element in its perfection consists in the relation of the inner globe to the arc, whereby with a suitably restricted air inlet a long arc may be steadily maintained by a small current. In the ordinary open arc lamp the carbon pencils, or sticks, burn away in ten or twelve hours, but in an inclosed lamp the cored carbons used will last from sixty to a hundred and twenty-five hours. The small inner globe inclosing them is of elongated oval shape and made of refractory glass, so as to resist successfully the intense heat of the arc. The consumption of carbon in the arc in this inner globe fills it with carbon monoxide and carbon dioxide, and as the globe is virtually air tight the prolongation of life in the carbon is due to the fact that little or no fresh air is admitted to help in the consumption of carbons. Moreover, the presence of carbon monoxide and carbon dioxide in the bulb shortens the arc to a length of three-tenths of an inch, and allows a pressure of 80 volts to be used; but although the pressure is thus increased to almost twice that of the earlier type, the consumption of power is not greater, as only half the current strength is required. These lamps have become popular with the public, because of their soft and steady light and brilliant appearance, and with central station managers, for the reason that as the carbons last so much longer the lamps need trimming only once a week and often only once a fortnight, depending upon the hours of nightly burning.

The latest development in arc lighting involves what is practically a reversion to the open arc, and the results are so striking that while the old open arc with its simple carbons may disappear entirely, the supremacy of the inclosed arc is likely to be seriously challenged by the flaming or luminous arc. The efficiency of light production is greater from incandescent gases than from solids, while amorphous carbon such as that used in the old carbon points is inefficient from the standpoint of light radiation. Hence if earth or metal having higher light radiating properties can be combined with carbon so as to become light giving in the arc, a high efficiency would result in the arc lamp using such impregnated carbons. The idea of introducing substances for the arc of higher radiating power than carbon was patented as far back as 1876, while experiments on the subject were made at least thirty years earlier. One of the first practical workers in this field in recent years was Hugo Bremer, of Germany, whose lamps were first brought to this country about four years ago and were employed in New York city. The principal feature of this lamp has been the employment of a compound carbon, the arrangement of carbons at an acute angle to each other, the use of a metal chamber above the arc for reflecting the light downward, and the employment of a magnetic field for the automatic regulation of the arc. In this lamp the carbons are forwarded or focused by gravity. When the arc lengthens to or near the breaking point as the "carbon" burns away, and thus makes it difficult for the arc to sustain itself, an electro-magnetically operated lever, used also to "strike" the arc when the lamp starts into operation, reestablishes the arc, and by its motion enables the electrode to feed until the arc reaches its normal length. Both the electrodes are of small diameter; the positive carbon being about five-sixteenths inch and the negative carbon about one-quarter inch. The negative carbon electrode is an ordinary solid carbon of the kind used in standard arc lamps, but the positive electrode is a cored carbon of special composition—that is, it contains metallic salts in considerable quantities, such as magnesium and boron. These two electrodes are inclined toward each other at an acute angle, and the points are surrounded by a metal chamber open below, like an umbrella. The magnesium in the positive carbon makes a snow-like deposit on the surface of this reflector, this white providing additional highly reflecting surface. The coating obtained in this way adheres to the metallic reflector surface to the thickness of about one-eighth inch. A simple arrangement is employed to obtain the magnetic field for the control of the arc, its strength being dependent upon the current flowing through the lamp, which gives an automatic character to the magnetic regulation. The color of the light is varied at will by the use of proper metallic salts, etc., and is

usually of a clear golden hue. The general principle of such lamps is that, on becoming heated by the passage of current, the salts which have been introduced into the carbon are volatilized and rendered incandescent. The hot gases thus generated furnish a path for the passage of the current of less resistance than the air.

The Bremer lamp has also been made with carbons vertical to each other as in the ordinary arc lamp. This is also true of the Blondel arc, in which only one of the carbons is impregnated with salts for increasing the illumination. The upper carbon is surrounded by a reflector, and the positive lower impregnated carbon consists of three parts—a core and two concentric layers around it. The outside layer is pure carbon; the middle and thickest layer is a mixture of carbon and salts, such as those of calcium, magnesium, etc.; while the central core has the same composition but is less compressed. The object of this arrangement is that the arc shall always remain in the center of the carbon and the carbon shall burn off uniformly. The thickness of the carbon varies with the size of the lamps. In the upper carbon, which with direct current is the negative one, the impregnation is very slight, and consists almost entirely of pure carbon. The vapors from the salt in the lower carbon rise into the arc and are heated to white heat and condensed on the reflector at the top of the lamp. The reflector consists of a central circular reflecting disk of insulated material and an external ring of metal. The Blondel lamps were first made for a current of 5 amperes or 3 amperes, but there is a later type which consumes only 1 ampere. These lamps burn normally on 50 volt circuits.

The flaming arc lamps as a class may be said to operate single on 55 to 65 volt circuits, or two in series on 110 to 120 volt circuits, and four in series on 220 to 240 volt circuits, on either direct or alternating current. The "carbons" burn from eight to fifteen hours, and are said to consume 0.163 watts per hemispherical candlepower in lamps of good efficiency. Some lamps have been used in this country which employ 17-hour carbons, but it will be seen that all such lamps, like the old open type of pure carbon arc lamps, are subject to the disadvantage of more frequent trimming than the inclosed arcs, necessitating the constant attendance of linemen and trimmers.

The magnetite arc lamp, like the "flaming" arc, has already gone into considerable use on street circuits. Its negative electrode consists of a stick of magnetite, while its positive electrode is simply a copper block. This lamp burns for one hundred and fifty hours, or as long as an inclosed arc lamp, but without necessitating an inner globe, while the production of light for 300 watts electrical power is rated as equivalent to that of the ordinary arc at 450 watts. The objection raised to this lamp, as to the others of the flaming arc type, has been the smoky deposit. The statement is made that pure magnetite, while fulfilling the requirements of a carrier of the arc flame, consumes rather quickly, and it has therefore had incorporated with it small quantities of substances, such as titanium compounds, for increasing the efficiency and steadiness of the arc and the life of the electrode. In the manufacture of these electrodes a greater density and longer life are secured by partially reducing the material to metal. Another method of improving the electrode is that of adding a "restrainer" or a substance which reduces the rate of consumption. A simple and satisfactory form of electrode is that in which the material is pressed as impalpable powder into a thin iron tube, which is then sealed over by the arc. In the ordinary carbon arc lamp the light comes from the incandescent crater of the positive carbon on direct current and not from the arc flame, whereas in the magnetite arcs, which are also operated on direct current, no light issues from the terminals but comes entirely from the arc flame; and hence an arc length of from $\frac{3}{4}$ to $1\frac{1}{8}$ inches has been found most efficient. The feeding mechanism differs from the "floating system" of the carbon arc lamp and is much simpler, involving a feeding device to maintain constant arc length. In the magnetite arc lamp, therefore, when the electrical pressure is applied to the lamp, the arc is struck, and the electrodes are separated to a definite distance, say, $\frac{7}{8}$ inch. The electrodes are then locked in this position and remain fixed until, by the slow consumption of the negative electrode, the arc length and thereby the arc voltage has increased sufficiently to operate the feeding mechanism, which resets the arc to its original proper length. An instance of work done with the magnetite lamp is afforded by Portland, Oreg., where after trying 800 lamps for several months the installation was increased to 1,200, these lamps, moreover, being operated by direct current obtained through mercury arc rectifiers to which alternating current is delivered at a pressure of 18,000 volts. These rectifiers will be referred to elsewhere. The magnetite arc lamps in use in Portland consume 320 watts in the lamp in place of 500 watts in the carbon arcs employed before, and obtain for 364 watts of transmitted power the same illumination that originally required 806 watts. This involves a saving of not less than 1,768 kilowatt hours per lamp per year. The cost of attendance on these lamps has been a little less than on the old direct current open arcs which they displaced, and the difficulties have gradually disappeared from operation. The outages that were noticed at first were due to the magnetite sticks. A button of hard glazed slag would form on the end of the stick and act as an effective insulator. The magnetite electrodes were made by the process of packing the magnetite powder or compound into an iron sheath or cylinder, as noted above. This was done at first by hand, with the result that it was uneven, and the slag formed when the sticks were packed too firmly. Machine

packing has, however, been adopted and this difficulty has practically been eliminated.

One further innovation in arc lamp practice is the introduction of lamps in which smaller carbons are used, the lamps having been tried with success in Chicago. It is claimed that there is a marked increase in the amount of light obtained from a given quantity of power as well as a whiter light. The light is steadier, as the arc can not wander so easily around the crater. The size of the carbon adopted is $\frac{5}{16}$ inch. On a 3.5-ampere lamp the use of $\frac{5}{16}$-inch carbons, as compared with the usual $\frac{1}{2}$-inch carbons, gives a consumption of 2.2 watts per candle, as against 3.4 watts with the $\frac{1}{2}$-inch carbons, or an increase of 50 per cent in light. It is necessary to change the lamps slightly to use the smaller carbons, and this is done in the local company's repair department. The gain in steadiness and efficiency is found to be of much importance, especially in meeting the competition of gas arc lamps. The company is now obtaining a life of about one hundred hours from the $\frac{5}{16}$-inch carbons. The smaller carbons do not blacken the inner globe as much as the larger carbons. With large carbons it was necessary, in order to secure good efficiency, to clean the inner globes every seventy hours, or once between each trimming. It is now unnecessary to clean between trimmings. The increase of efficiency by the use of smaller carbons, as well as the greater steadiness and improved color of the light, due to the fact that there is not such a preponderance of violet rays, are matters upon which laboratory tests are hardly necessary, as they are apparent even to the casual observer. Before $\frac{5}{16}$-inch carbons were made the company's standard, the matter was exhaustively tested. Some alternating current arc lamps have also been equipped and put in service with $\frac{5}{16}$-inch carbons, with great improvement in the illumination. Small arc lamps of this general type have also been tried in Germany, within the past year, with the object of closing the gap between the standard arc and the ordinary incandescent.

In the group of arc lamps must be included searchlights and projectors. Table 11 shows statistics of this type of lighting devices for 1900 and 1905.

TABLE 11.—*Searchlights and projectors—number and value: 1905 and 1900.*

STATE.	Number.	Value.
United States, 1905	1,924	$114,795
1900	8,283	225,635
States, 1905:		
California	490	16,147
New York	1,050	47,267
All other states [1]	384	51,381

[1] Includes states as follows: Colorado, Illinois, Indiana, Michigan, New Jersey, Ohio, Pennsylvania, and Wisconsin.

According to the table the number had decreased 77 per cent, while the value had decreased about one-half. On the face of it there would appear to be a serious decline in this class of production since the year 1900, but there are some reasons which would indicate the existence of conditions of a nature more satisfactory to the manufacturers. As will be seen, the average cost per searchlight had risen in the period from $27 to $60, but this is in reality due to an increase in the size and capacity of the searchlight. It is now some years since searchlights were found a desirable and necessary adjunct on board steamships of all sizes, with the result that practically all vessels of American register have been equipped with them. The field of consumption having been thus filled up, practically the only market that is left is the annual accessions to the merchant marine, and it will be seen that 1,924 searchlights would probably take care of all the additions to the steamship fleets of the United States. The merchant marine and the additions to the Navy are practically the only outlets for the manufacturers of searchlights, and the figures quoted indicate that the market has been well taken care of, the other searchlights not accounted for thus being required chiefly for renewals or for ships not previously equipped. This group would also include probably some larger focusing lamps of the kind used for theatrical purposes; but these again have not been treated separately and are very often merely large arc lamps of the ordinary type.

Incandescent lamps.—Table 12 shows the number and value of incandescent, and decorative and miniature lamps, etc., for 1900 and 1905.

TABLE 12.—INCANDESCENT, AND DECORATIVE AND MINIATURE LAMPS, ETC.—NUMBER AND VALUE: 1905 AND 1900.

STATE.	Aggregate value.	INCANDESCENT LAMPS.							DECORATIVE AND MINIATURE LAMPS, X-RAY BULBS, VACUUM TUBES, ETC.	
		Total value.	16 candlepower.		Below 16 candlepower.		Above 16 candlepower.			
			Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
United States, 1905	$6,953,205	$6,308,299	83,333,285	$4,608,084	19,779,834	$1,132,011	9,598,439	$568,204	1,584,495	$644,906
1900	3,515,118	3,442,183	21,191,131	2,910,023	2,906,817	308,626	1,222,250	223,534	397,432	72,935
States, 1905:										
Illinois	92,500	(1)	(1)	(1)	(1)	(1)	(1)	(1)	601,010	92,500
Massachusetts	898,000	898,000	7,694,243	834,675	(1)	(1)	384,423	63,325	(1)	(1)
Missouri	346,841	346,841	20,498,570	346,841	(1)	(1)	(1)	(1)		
New Jersey	10,235	(1)	(1)	(1)	(1)	(1)	(1)	(1)	32,461	10,235
New York	239,810	(1)	(1)	(1)	(1)	(1)	(1)	(1)	654,972	239,810
Ohio	1,591,438	1,591,438	33,915,818	1,076,057	7,901,719	303,168	4,436,415	212,213	(1)	(1)
Pennsylvania	29,417	29,417	365,503	27,790	(1)	(1)	17,819	1,627	(1)	(1)
All other states	3,744,964	3,442,603	[2] 20,859,151	[2] 2,322,721	[3] 11,878,115	[3] 828,843	[4] 4,759,782	[4] 291,039	[5] 296,052	[5] 302,361

[1] Included in "all other states."
[2] Includes states as follows: California, Colorado, Connecticut, Illinois, Kentucky, Maine, Michigan, New Jersey, New York, Oregon, and Texas.
[3] Includes states as follows: California, Colorado, Connecticut, Illinois, Kentucky, Massachusetts, Michigan, Missouri, New Jersey, New York, and Pennsylvania.
[4] Includes states as follows: California, Colorado, Connecticut, Illinois, Kentucky, Michigan, Missouri, New Jersey, and New York.
[5] Includes states as follows: Connecticut, Iowa, Massachusetts, Ohio, Oregon, Pennsylvania, and Rhode Island.

One of the largest specialized departments of electrical production is that of incandescent lighting. The gain in this branch since the year 1900 has been quite remarkable, the total value rising from $3,515,118 to $6,953,205, so that the amount has almost doubled in the period. The principal gain as to quantity and value has notably been in 16-candlepower lamps, which remain the standard, although there are indications that it is likely to be raised, owing to the competition of gas of higher candlepower than was common when the incandescent lamp was introduced. The number of incandescent lamps of 16 candlepower has risen from 21,191,131 to 83,333,285, and the value has nearly doubled, but it will be seen from the table that there has been a remarkable reduction in value per lamp, so that these lamps reach the consumer at a retail price proportionately reduced. Lamps below 16 candlepower in illuminating capacity are used to an increasing extent for various purposes, and the number increased from 2,906,817 to 19,779,834, or more than fivefold. The value rose from $308,626 to $1,132,011. In like manner there was a remarkable increase in the number and value of the lamps above 16 candlepower, these being principally 32 and 50 candlepower. The number increased from 1,222,250 to 9,598,439, the gain being almost sevenfold. The increase in decorative and miniature lamps, etc., is not so great as might have been expected from the prevalence of street signs, but the increase was from 397,432 to 1,584,495, with a correspondingly large increase in the value. As a matter of fact, a large proportion of lamps below 16 candlepower are employed for decorative and sign purposes. It is only in the group of decorative and miniature lamps that an increase in price per unit is shown, but this is due to the attempts to place at the disposal of the public very small lamps of ingenious design and construction for special effects. In reality, the product throughout the group as a whole shows a remarkable reduction in cost, the more noteworthy in view of the fact that during the past five years nearly fifty manufacturers have allied themselves under the protection of certain patents, standardizing their methods of production and quality of output. This combination does not constitute a monopoly, as there are also a large number of independent manufacturers.

The importance of the incandescent lamp in the field of electrical industry is evidenced by the fact that, as shown by the statistics of the Bureau of the Census in the Report on Central Electric Light and Power Stations, out of a total of 3,620 private and municipal stations enumerated in 1902 no fewer than 3,484 were engaged in commercial or other private incandescent lighting, while 606 private and municipal plants reported that they were engaged exclusively in the business of incandescent lighting. Further evidence as to the importance of the incandescent lamp was given by the fact that of the total income of all stations of $85,700,605 more than half—$44,657,102—was derived from incandescent service. It is true that during recent years the supply of electrical energy for motive-power purposes from central stations has gained rapidly, but in view of the enormous increase in the production of incandescent lamps it would appear that the proportion of income from light thus exhibited has at least been maintained, and when compared with the income from arc lighting may be said to have increased. In view of these points, it will be readily understood that among manufacturers as well as among central station managers and the owners of isolated plants there has been seen an extraordinary demand for improvements in the manufacture of incandescent lamps, resulting in the last five years in an outburst of research and invention in this field that changed its aspect entirely. The use of the electric street sign has also had a very marked effect on the production of incandescent lamps, and the result of an inquiry made by one of the central station companies during the past year shows from the data furnished by 1,188 central station companies that no fewer than 75,000 electric street signs were in use in the United States, yielding an income of over $4,000,000 a year from power consumption.

Before noticing the more radical innovations in the art of incandescent lamp manufacture it is well to put on record the improvements which have come from the perfection of familiar processes, and have gradually reduced the selling price of the lamp of the carbon filament type to a point where practically ten lamps are sold for a dollar instead of one. The carbon filament lamp, when introduced, contained about thirty times as much platinum in the leading-in wires to which the carbon strip is attached as does the lamp of the present day. The exhausting of air from the lamp by mercury pumps in order to create a high vacuum now requires but a single minute, where half an hour was necessary ten years ago, and from four to five hours at the beginning of the art. As a matter of fact twenty-five years ago the mere cost of exhausting a lamp was greater than the whole cost of the lamp at the present time. All the glass blowing operations on the bulb have been changed from hand work with expensive skilled labor to machine work that a tyro can regulate, and the labor cost of the glass processes is barely 10 per cent of what it was in 1882. All the lamps sent out are tested by photometric process, but to-day that incidental work costs but one-tenth of what it did formerly. The first successful lamps were based upon carbon filaments made from paper and bamboo, but at a very early stage cellulose material was employed, and it has now come into universal use. Such lamps, of a standard 16-candlepower capacity, require but 50 watts of electrical power for their full efficiency, so that the current consumption has also

been cut in two. It is estimated that in the first quarter of a century 250,000,000 incandescent lamps of carbon filament type were produced, or at the average rate of 10,000,000 a year; but, as the figures already quoted indicate, the total number is now over 100,000,000 a year.

It is probable that for some time to come lamps of the carbon filament type will continue to be manufactured in large quantities, but even in these important improvements have recently been made, the object being to secure high candlepower with less consumption of current. The principal lamp of this modified character has what is known as the "metallized" carbon filament, which is rated at 2.5 watts per candlepower, as compared with the plain carbon filament type, whose standard consumption has been 3.10 watts per candlepower. The new filament is obtained by applying an additional process to the ordinary carbon filament, the treatment including heating in an electric furnace to a temperature of from 3,000° to 3,700° C., this firing being performed both before and after treatment. The additional processes result in the production of an exceedingly pure form of carbon, having greater density and considerably less specific resistance than the older filament, while the temperature coefficient is changed from negative to positive. For this latter reason the term "metallized" has been employed to describe the new filament, although it contains no metal. These lamps are now generally available in all the standard sizes and have immediately become popular.

A far more important and radical advance is that which has been made in the production of incandescent lamps with metallic filaments in place of carbon. Some of the very earliest work in the subdivision of electrical current for lighting purposes was done with filaments of a metallic character, such as platinum, but these were found at the time insufficient to serve as the basis of a commercial art, although hope in that direction was not entirely abandoned. Experiment has been maintained for many years, and the first success is due, as in so many other fields of chemical and metallurgical research, to the perseverance of German scientists. Several years ago, with the fundamental principle as a starting point, that the visible part of radiation from an incandescent lamp filament increases progressively with the temperature of the filament, elaborate laboratory experiments were begun in Germany to discover a metal that would withstand a much higher temperature than the carbon lamp filament can endure economically. The result of a long series of tests was to determine the selection of tantalum, which in a pure state was found to yield very satisfactory results.

The chemical properties of tantalum are very remarkable. When cold, the material strongly resists chemical agents; it is not attacked by boiling hydrochloric acid, nitric acid, or sulphuric acid, and it is also indifferent to alkaline solutions; it is attacked solely by hydrofluoric acid. Heated in the air, it assumes a yellow tint at about 400° C. like steel, and also like steel the tint changes to dark blue when the tantalum is exposed for some time to 500° C. Thin wires of it when ignited burn with low intensity and without any noticeable flame. It greedily absorbs hydrogen as well as nitrogen, even at a low red heat, forming with them combinations of a metallic appearance, but rather brittle. It combines with carbon very easily, forming several carbides which, as far as they are at present known, are all of metallic appearance, but very hard and brittle. When in the form of powder, still containing, as previously stated, oxide and hydrogen, the specific gravity is about 14; when purified by fusion and drawn into wire, it has a specific gravity of 16.8. It is somewhat darker than platinum and is about as hard as mild steel, but shows greater tensile strength. It is malleable, although the effect of hammering is relatively small, so that the operation must be long and severe to extend the metal into a sheet. It can be rolled as well as drawn into very fine wire. Its tensile strength as a wire is remarkably high and amounts to 133,000 pounds per square inch. The electrical resistance of the material at indoor temperature is 0.165 ohm for a length of 1 meter and a section of 1 square millimeter; the temperature coefficient is positive and has a value of 0.30 between 0° and 100° C. At the temperature assumed by the incandescent filament in the lamp under a load of 1.5 watts per candlepower, the resistance rises to 0.830 ohm for a length of 1 meter and a section of 1 square millimeter. The Siemens-Halske Company in Germany has taken out about 200 patents on the tantalum lamp, comprising about 1,000 claims. Experiments with many hundreds of the tantalum lamps gave a useful life of four hundred to six hundred hours, during which it consumed about 1.5 watts per candlepower. Useful life is defined as the time at the end of which the lamp has lost 20 per cent of its "light power." The candlepower increases during the first one hundred hours, whereby the specific power consumption decreases to about 1.3 watts per candle. The latter then increases, and at the end of the useful life the lamp consumes 1.8 to 2 watts per candle. The lamp, however, continues to burn for one thousand or one thousand five hundred hours. It is found to burn much better on direct than on alternating current, as the latter appears to disintegrate the filament rapidly; and in the United States it is now being used only on direct current circuits. The price to the retail purchaser of a 22-candlepower tantalum lamp, consuming 44 watts of electrical power, is 60 cents; and the New York Edison Company, which supplies new lamps free to its customers, makes a charge of 35 cents for this lamp. This practice may be taken as an index of the general practice

of the central station companies in introducing the new illuminant. The makers in Germany have produced and placed on the market a 2.2 watt lamp for pressures of 50, 55, 60, 65, 75, 100, and 110 volts, whose useful life is quoted as being from eight hundred to one thousand hours, with the total life often reaching one thousand five hundred or two thousand hours.

Another lamp of the metallic filament type is the osmium, which has been introduced to some extent in Europe but is not yet widely known in the United States. The crude material is very finely divided osmium—one of the rare metals—which is mixed with binding substances so as to form a thick, tough paste, which is forced under very high pressure through a die. A thread is thus obtained, which is formed into loops. The threads are then dried and heated in a vacuum in order to carbonize the binding material, and they are next subjected to the processes of formation. The threads, which at this stage consist of porous, rough osmium with a high content of carbon, are heated for a long time by means of electric current, being brought gradually through higher and higher temperatures to white heat in an atmosphere containing a great deal of steam and various quantities of reduced gases. In this manner the filament becomes pure porous osmium of a far greater density than the original rough thread. During the use of the lamp the osmium surface becomes gradually smoother and smoother, which accounts for the increase in the light given out by the lamp in the first few hours of use. The filament, which has an approximate length of 15 inches, is divided into three separate loops connected in series by means of two loops of platinum wire, the middle of each of which is fused, by means of a glass bead, to the top of the stem carrying the two leading-in wires. Each filament is anchored in order to prevent the loops from touching the dome of the bulb, and the anchor device consists of a small glass rod to the end of which is attached a turn of small wire or white refractory metal. The filament is anchored not at its extremity but somewhat above the turn of the loop. The lamps can be burned only in a vertical downward position. The consumption is 1.5 watts per candlepower, and the standard type is a 50-volt 25-candlepower lamp, guaranteed at that consumption of electrical power. The useful life of the lamp is given as about two thousand hours, but some have been burned five thousand hours. The osmium lamp is somewhat more fragile than the ordinary carbon filament lamp if exposed to hard knocks, but it seems able to withstand a great deal of vibration, as in train lighting, for which it has proved satisfactory in connection with storage battery equipments. Its low voltage has also made it desirable for mine safety lamp purposes.

Another lamp of this character is one in which the filament is made from a metal alloy of which the rare metal zirconium is a component. Lamps of this kind require only a small pressure, such as 2 or 4 volts, and hence, like the osmium, are available more particularly in connection with storage batteries. Tests on these lamps show that 2-candlepower lamps at 4 volts give a consumption of 0.92 watt per candlepower, whereas the ordinary carbon filament lamp of the same low candlepower consumes 3.8 watts. The lamp is expensive in first cost, but, as will be seen, the cost of operation is low, and a more recent lamp of this type is reported to have a consumption of 1.2 watts per candlepower with a life of five hundred hours, but needs careful handling and is commercial only on low voltages.

The latest development in metallic filaments for incandescent lamps relates to the work on tungsten, conducted principally abroad, although in the last three or four years a large amount of research and investigation has gone on in the United States also. The merit of the tungsten lamp consists in the fact that it consumes only between 1 and 1.25 watts of electrical power per candlepower, as compared with the 3.10 of the ordinary carbon filament type, 2.5 of metallized filament, and the 2 watts of the tantalum lamp. While tungsten is considered one of the rare elements, its compounds are already of considerable use. Sodium tungstate is employed in impregnating fibers to make them fireproof, and as a mordant in dyeing. Tungsten bronzes are employed largely as bronze powders and pigments. The chief employment of tungsten in recent years, however, has been for high-speed tool steels and for ordinary steel in armor plates and large guns. A few years ago very little was produced in this country, but the quantity of tungsten concentrates reported for the year 1905 was 803 tons. The tungsten concentrates valued formerly at $2 or $3 per unit are now worth at least $6 per unit, the unit meaning 1 per cent of a ton. It will be obvious, therefore, that tungsten is a rare element, although not in the same sense as osmium or platinum. Like most metals proposed for incandescent lamp filaments, tungsten has a lower electric resistivity than carbon, and for this reason the manufacture of high voltage tungsten lamps is a more difficult process than is the production of carbon lamps for the same voltages—say, the standard, 110. In the main, however, these difficulties in the manufacture of tungsten lamps have been successfully overcome, as the lamps are now on the market in both Europe and the United States.

The fundamental value of tungsten for lamp filaments lies essentially in its enormously high point of melting or volatilization. In this respect it perhaps resembles carbon and the nonmetallic elements. In the common use of the word "metal," pure tungsten is virtually unknown. It has not yet, for instance, been reduced to ingot form from which anything could be hammered, or cut, or drawn. Hence, so far as is known, a filament of wire such as is used in the tantalum lamp, for example, can not be paralleled or dupli-

cated from tungsten, so that the filaments now in use in tungsten lamps have to be obtained by what may be called roundabout methods, and when completed are like carbon filaments, aggregations of amorphous structures or of infinitesimal crystals. Three different processes are in use for making tungsten filaments.

The first process is based on the effort to coat a carbon filament with tungsten and results in the simultaneous dissolution of the carbon filament, and its replacement by finely divided tungsten, which is strengthened by a process akin to "flashing," or, in other words, the heating up of the filament in the vapor of a tungsten compound. The other two processes start with very finely divided tungsten, worked up into a paste, from which the filaments are formed. Further treatment is then given by firing. The earlier processes dealt with a paste made of what may be called precipitated tungsten. The later process is based on so-called colloidal metal, which presents the advantage of almost infinitely fine subdivisions. The result is of the same nature, whether the filament is prepared by the "substitution" process, the paste process, or the colloidal process—namely, an extremely fine thread 1 or 2 mils in diameter, of compactly aggregated pure or nearly pure tungsten. These filaments are dense and of smooth and uniform appearance, but thus far appear to be quite brittle, as might be anticipated from their structure. The elimination of this tenderness is one of the problems of the future for this new lamp. These lamps have an advantage over the tantalum in the fact that they can be burned equally well on both alternating and direct current; but like the tantalum, the tungsten lamp is best burned in a vertical downward position, although in this respect it more nearly resembles the osmium. The lamps that have been introduced commercially are rated at 25 candlepower, consuming 1 watt per candlepower and are given a life of not less than one thousand five hundred hours. A standard lamp introduced in Europe and already known in the United States consumes 40 watts and has three filament loops with a total length of filament of 17 inches.

The statistics of decorative or miniature lamps, etc., include also vacuum tubes, vacuum and vapor lamps, and X-ray bulbs, which are not enumerated separately. The vacuum tubes and lamps are used for lighting and for photographic purposes. The X-ray is now employed almost exclusively for surgical investigations, chiefly those by which the interior of the human body can be inspected, and broken bones, foreign substances, etc., be located. The vacuum tubes consist principally of those based upon the utilization of the vapor of mercury. This type has been upon the market since 1903 and has come into extensive use. The words "vacuum tube" are employed generically to distinguish the exhausted bulbs or lamps which contain no filaments, but which have in them gases other than air or such metals as mercury, which will when vaporized "carry the arc," so to speak, and will thus maintain illumination. In the leading lamp of this type the light giving element is a gaseous vapor of mercury inclosed in a hermetically sealed glass tube, varying in length from 17 to 45 inches, and about 1 inch in diameter. This tube is suspended from the ceiling and is mounted on a tilting arm, suspended from a pendant canopy which contains the regulating mechanism. When the current is turned on the mercury becomes vaporized, thus maintaining the circuit throughout the length of the tube, which becomes wholly luminous. The complete lamp outfit may be said to comprise the exhausted glass vacuum tube, the holder and reflector, and the auxiliaries.

The tubes intended to operate on direct current have a positive electrode of iron at one end and a negative electrode of metallic mercury in a bulbous cup at the other end. The tubes for alternating current lamps have two positive electrodes of iron at one end and a negative electrode of mercury at the other end. The alternating current enters the vacuum by the positive electrode and leaves the tube by the negative electrode. These alternating current lamps operate in reality as a converter, in application of the principle of negative electrode resistance, which will be referred to later. In all types of the tube the terminal connections to the sources of electrical supply reach the electrode through platinum wires. The lamps are set in operation by tilting them for an instant, either mechanically, by pulling a small chain attached to the upper end, or automatically, by means of a small magnetic attachment. This tipping of the higher end of the tube causes the mercury to flow from one end to the other in a small stream, which bridges the vacuum in the tube momentarily, thus closing the circuit through the tube, and the resulting arc of current vaporizes some of the mercury. The subsequent steady flow of electrical current in the vacuum, after the return of the lamp to the normal position at a slight angle, increases the vapor pressure and excites it to a high degree of luminous incandescence. The holder or fixture bracket for the tube consists of a lamp rod with clamps, from which the tube can be easily removed or inserted, and the suspension bar hung close to a light colored ceiling without reflectors, or else equipped with flat or curved reflectors of different styles. The standard flat reflectors, 6 inches wide, are used generally where the lamps are hung at some distance from the roof or ceiling. The faces are white enameled so as to increase the diffusion of light, while the reflector tops and holders are finished in a lustrous black. The auxiliary consists of two or three coils of resistance wire, an inductance coil, and a ballast bulb intended to correct abnormal voltage variations on the line, all being connected in series with the tube. This auxiliary mechanism is placed within a

small canopy, heat insulated from the ceiling by an asbestos shield, and fastened to the ceiling on a plate attachment having a claw foot into which the suspension bar is secured.

The standard type of lamp of 700 candlepower for direct current is 55 inches long, with a length of 45 inches of light-giving tube. It is operated at 3½ amperes and consumes 385 watts when installed single on 110 volt circuits, or 0.55 watt per candlepower.

The direct current lamp is made in two sizes—one 24 inches long, 17½ inches of tube, giving 260 candlepower; and the other 27½ inches over-all length, with 20¾ inches of tube, giving 300 candlepower.

The alternating current lamp of 425 candlepower is 34 inches long, with a 28-inch tube, and is designed to operate on all single phase circuits of a frequency of 60 cycles or more. It consumes 275 watts, or 0.64 watt per candlepower. These tubes appear to have a long life, ranging in many cases over ten thousand hours, although they become somewhat blackened with long service.

The absence of red rays in the mercury vapor lamp renders it undesirable or inapplicable for every purpose, but it is found particularly useful in industrial and other plants, and it may be noted that all the United States Government currency and internal revenue stamps are printed under its light in the Bureau of Engraving and Printing at Washington, where the nature of the presswork requires a high quality of widely diffused light. Another typical instance of its use is in the New York Times building, where no fewer than 42 of these tubes are employed, of which 26 are in the press and stereotyping rooms, lighting an area of 1,700 square feet. Mr. Peter Cooper-Hewitt, who is to be credited with the development of this lamp, has improved the color of the light by the addition of the vapors of lithium, potassium, and rubidium, which will, however, attack the tube if made of quartz. Other attempts in the direction of changing the color of the light involve the introduction of inert gases, such as neon, nitrogen, or argon. Means adopted, external to the lamp itself, to supply the deficiency of red rays have met with no marked success. In the meantime the lamp, during the past two or three years, has become so widely used as no longer to excite comment, and the prejudice or objection to the color has died out so far as any industrial work is concerned.

There are one or two other systems of mercury vapor lamps, including those in which incandescent lamps have been associated with the tube, so as to secure an agreeable blend of the two lights. A more distinctive variation, however, is found in the Moore system, which is based upon considerable lengths of tube, ranging as high as 200 feet all in one stretch, giving an unbroken band or cornice of light around the room or space thus illuminated. These long tubes are made on the premises of the customer by sealing hermetically together tubes that come in lengths of 8 feet 6 inches, a new portable gas fire having been worked out for this purpose. The lamp is of the alternating current type, the electrodes reversing their sign at each alternation, necessitating high voltage to be applied at the terminals in order that the intervals between the successive impulses will not be apparent to the eye, which would otherwise be disagreeably affected by the unsteadiness or fluctuations of the light. All the distinctly electrical apparatus is placed in a single steel case or box, from which the tubes extend for illuminating purposes. A low-potential alternating current circuit supplies the apparatus with electrical energy at 60 cycles, and the tube contains a nonmetallic gas or vapor under very small pressure. The terminal of the tube within the box contains at each end carbon internal electrodes. Within the box also is the step-up transformer, to the low-potential coil of which current is supplied, the high-potential terminals being attached directly to the tube electrodes. Hence the only wires extending from or into the box are the ordinary low-potential service wires. Some of these tubes are 150 to 200 feet in length with a diameter of 1¾ inches, operating at a brilliance of 4.2 candlepower per foot of tube. The efficiency varies with the length of the tube, and an actual total candlepower for one instance is claimed of 2,200 with a total consumption of 3,300 watts. The tube, in addition to being operated in continuous lengths—as, for example, around the four sides of a room or of a long passageway—can be bent back and forth into frames for photographic purposes or can be made to follow the irregular outline of a building or portico, and can even be twisted so as to form letters and spell words. In this last form it lends itself admirably to advertising purposes. The color of the light is excellent, and for the illumination of large areas such tubes appear to have a promising future, although apparently they can not be used economically in small units or short lengths. An effective illustration of their employment is furnished in one of the largest department stores in New York city, where two tubes of 154 feet each, attached to the ceiling of a basement floor, have displaced nine arc lamps and give effective and agreeable illumination over goods of a very varied nature.

In passing, a most ingenious and important utilization of the mercury bulb or vacuum tube must be noticed in respect to its use as a converter, transforming alternating to direct current in places where only the former is available and only the latter is desired. The possibility of conversion of alternating current into direct current in this manner depends upon the laws which underlie the familiar starting characteristics of the mercury vapor lamps. In the lamp the reluctance to start was in some respects an obstacle,

while in the converter the whole function depends upon this resistance; and the invention was an extremely ingenious means of rendering useful what was otherwise a troublesome characteristic. Various types of this apparatus are now largely used, principally for the charging of storage batteries from an alternating current circuit, and but for the existence of this device the batteries which can be charged only with direct current would require step-down transformers and rotary converters. In other words, they would need costly miniature reproductions of the substations familiar in electric railway and central station lighting.

The whole transformation of current for a set of automobile storage batteries takes place in a vacuum glass bulb resembling a very large pear, in the standard outfit about 9 inches in diameter. This glass globe has two or more positive electrodes of iron at the top, by which the alternating current enters the vacuum. At the bottom of the globe is a small pool of mercury constituting the negative electrode through which the current takes a continuous or direct outward flow to the batteries or other devices. Through the action of the negative electrode resistance, the positive electrodes pass current only into the bulb, and oppose any flow of the current from it. The current can therefore flow in one direction only—through the pool of mercury at the base of it—so that the impulses, waves, or fluctuations of alternating current are diverted from the alternating circuit and leave the vacuum in the form of the desired positive or direct current. The starting resistance of the negative mercury electrode is overcome by tilting the converter bulb until the mercury connects with the mercury of a small supplementary electrode, and current passes between the two. This tilting is accomplished automatically when the alternating current and direct current switch and the converter switches on the panel board in front of the globe are thrown in, and is repeated automatically upon the resumption of the flow of line current after interruption from any cause, so that an excellent protection is afforded against reversal of current. The efficiency of such apparatus is said to be not less than 80 per cent in supplying current at 115 volts to a set of from 20 to 44 cells of storage battery, and the whole converter equipment occupies a space of but 15 by 22 by 26 inches. Such an equipment has a minimum operating current of about 6 amperes and a maximum capacity of 30 amperes in continuous running, giving direct current voltage of from 50 to 115 volts. It may be noted that a certain amount of voltage is absorbed in the converter bulb itself, namely, 15 volts, which is practically independent of the volume of current flowing and which appears as heat and a slight quantity of light within the bulb and which is dissipated into the air through the glass.

A type of lamp that belongs in neither the arc nor the incandescent field, but which is also included in the statistical group of decorative and miniature lamps, etc., in Table 12, is the Nernst, which has come into widespread use since the date of the last report, and is now in operation in connection with hundreds of central stations and isolated plants in the United States. This lamp, which owes its origin to a German scientist, has as its light-giving member a glower, which although not brought to incandescence in a vacuum, as is the filament in the ordinary incandescent lamp, at the same time does not burn away as does the carbon in the various forms of arc lamp. The glower is made by passing through a die a dough composed of the oxides of rare earths, mixed together with a suitable binding material. A porcelain-like thread or string is thus obtained which is cut, after drying, into short, convenient lengths and is then baked. Platinum terminals are attached to these glowers, which are then ready for insertion in the lamp. The terminal connections between the glowers and the leading-in wires, as made by Doctor Nernst, consist of a few turns of platinum wire around the end of each glower, the convolutions being finally pasted with cement. A later form of successful terminal is that in which little beads of platinum are embedded in the glower ends, to which the leading-in wires are subsequently attached in such a manner that any shrinkage of the glower material results in a firmer contact with the platinum. The peculiar feature of glowers is that when cold they are insulators, but they become conductors when hot, so that they must be heated before they will pass electrical energy sufficiently well to maintain themselves at a light-emitting temperature. Moreover, as the glower is an oxide, incapable of further oxidization, it is operative in the open air or within loosely closed globes, and being, moreover, capable of withstanding a much higher temperature than is the filament of the ordinary incandescent lamp it admits of great economy in operation, while furnishing a light of remarkably superior white quality and color. The glower in a standard 220-volt Nernst lamp is 1 inch long by $\frac{1}{32}$ inch in diameter. Hence it is in sharp contrast to the ordinary carbon filament as to length and thickness. It is obvious that as the glower is a nonconductor when cold it requires some form of heater to bring it up to a conducting temperature, so that current can flow through it and cause incandescence. The glower becomes a good conductor at about 600° to 700° C. Various forms of heaters have been made to work automatically, as the earlier forms of lamps in which the heating was done by hand were far too slow and cumbrous for commercial practice. The heaters in common use consist of thin porcelain supports mounted with fine platinum wire, which in turn is held in place and protected from the intense heat of the glower by a refractory paste.

Associated with the heater is a cut-out, which disconnects the heater from the circuits as soon as the glower lights up, which takes several seconds. The

cut-out comprises a small coil, an armature, and contact, the coil being heat proof and embedded in cement, while the contact is nonoxidizable, being of silver. The heater circuit is normally kept closed by the force of gravity, as the lamps are operated in the downward position, although a successful form of universal cut-out is available which will operate with the lamp in any position. The mode of operation of the lamp is therefore the admission of current to the heater, making it white hot, whereupon its proximity to the glower causes the latter to become a conductor through which the current then passes. When the current through the glower has reached the predetermined proper amount, the cut-out coil becomes energized by the glower current passing through it, and the arm of the cut-out which had hitherto closed the heater circuit is attracted and opens the heater circuit, so that only the glower is left in operation.

Another part of the lamp is its ballast, or steadying resistance, of fine iron wire. The conductivity of the glower increases with the temperature, so that if used directly on a constant potential circuit this temperature would continue to rise, and very soon the increasing amount of current flowing would destroy the glower. Hence the steadying of the current is accomplished by this ballast of iron wire, which possesses the property of increasing its resistance with great rapidity on reaching the critical temperature, and operates to prevent short circuiting, or "flashing out." Thus with a 10 per cent rise in current, the increase of resistance in the ballast is 150 per cent, so that the glower is thus protected through a wide range of supply voltages. This iron wire is guarded from the air to prevent its oxidation and the rapid change of temperature, and is therefore mounted in a little glass bulb filled with hydrogen, which is an inert gas and conducts the heat from the ballast to the walls of the bulb better than other gases. These diminutive working parts are all mounted in the lamp body in a suitable manner. The glower and its heater of course project into the surrounding glass globe, while the other parts are inclosed in a canopy from which the globe depends. The main features are alike in all the lamps, and various sizes, or degrees of illumination, are obtained by assembling one or more standard glowers with their auxiliaries within the canopy and globe. Hence the smaller lamps are burned with but a single glower, while in the larger type as many as six glowers are employed. The perishable parts, such as glowers, heaters, and ballasts, are easily renewed, being mounted in removable pieces called the "holder," which may be pushed into place or taken out like an incandescent lamp with regard to its socket. The lamps are burned usually on alternating current at a frequency of 60 cycles and preferably at 220 volts, those in use in this country having a range of use on any frequency of from 25 to 133 cycles. The lamps are made for both 110 and 220 volts, and one glower lamp at 110 volts has a consumption of 44 watts of electrical power. The 6-glower lamp at 110 volts has a consumption of 556 watts and at 200 volts a consumption of 528 watts.

A development of interest during the past year in connection with the Nernst lamp has been the making of a series lamp of moderate candlepower for street illumination, thus allowing the lamp to be used in places where a fairly large number of small units is required. The outfit consists of a single glower lamp connected with a series transformer, the primary coil of which is adapted for a circuit carrying 6.6 or 7.5 amperes of constant alternating current. Hence the lamp may be used on any of the constant current series systems, and the ordinary 50-light "tub" transformer will energize about 200 lamps of this new type. The glower and heater in this particular form of lamp are mounted in a vertical position on a porcelain base, and the heater is made in the form of a helix around the glower. Another exemplification of the use of the lamp is afforded by the huge new terminal of the Pennsylvania Railroad in New York city, for which this type of lamp has been adopted, and for which no fewer than 20,000 glower units will be required.

Lighting fixtures.—Table 13 presents statistics of electric light fixtures for 1900 and 1905.

TABLE 13.—*Electric light fixtures—value: 1905 and 1900.*

STATE.	Total value.	Fixtures (value).	Lamp sockets, receptacles, bases, etc. (value).
United States, 1905	$5,305,466	$3,294,606	$2,010,860
1900	4,344,599	3,750,670	593,929
States, 1905:			
California	447,109	447,109	
Connecticut	1,694,785	397,498	1,297,287
Illinois	639,405	639,405	(1)
Minnesota	7,000	7,000	
New York	1,063,945	1,063,945	(1)
Ohio	150,500	150,500	(1)
Pennsylvania	406,610	406,610	(1)
All other states	896,112	[2] 182,539	[3] 713,573

[1] Included in "all other states."
[2] Includes states as follows: Colorado, Delaware, Massachusetts, Missouri, New Jersey, Oregon, Rhode Island, and Texas.
[3] Includes states as follows: Illinois, Massachusetts, New York, Ohio, Pennsylvania, Rhode Island, and Texas.

A considerable increase is shown in the value of electric light fixtures of all kinds reported in 1905, the amount being $5,305,466, as compared with $4,344,599 in the year 1900. The increase is accounted for to a great extent by the larger manufacture of sockets and bases incidental to incandescent lamps, for which an increase of 238.6 per cent was shown for the period, but the bulk of the amount is, as before, represented by the fixtures themselves. It will have been gathered from the preceding data as to the development of electric lamps of new forms and characteristics, that there has been a considerable development also in the fixtures to hold these lamps, none of these newer fixtures being known or included in the statistics at the time

of the previous census. The Moore vacuum tube, the Hewitt and Steinmetz mercury vapor lamps, and the Nernst lamps all require special fixtures of their own for their most efficient use, and even some of the new forms of incandescent lamps have had special fixtures carefully designed for them, in order to secure the best results in diffusion and distribution of light. For example, the new metallic filament lamps are associated with fixtures and special types of holophane reflectors, which are harmonized in their relationship to the lamp and to each other, with a great gain in efficiency of illumination and of general artistic effect. As a matter of fact, the whole art of fixture designing and construction has undergone a very marked change and improvement during the last few years, on account of the coming into existence of the distinctively new branch of illuminating engineering, which is already so well recognized that it is represented by a national society with upward of 500 members. It has been estimated that the yearly expenditure for lighting in the United States is well above $200,000,000, of which at least $20,000,000 is wasted on account of the use of improper fixtures, shades, reflectors, etc., and the aim of these specialists in illumination is to work in close relationship with the architect, the decorator, and the designer of gas and electric fixtures.

The modern art of illumination may be said to have broken away entirely from the standard and stereotyped bracket and chandelier associated with the use of gas. The adoption of electricity, with its greater flexibility of application, has permitted the use of many methods quite impossible with other illuminants. It is obvious, even to the casual observer, that a great deal of modern lighting within doors is done without fixtures and is in the nature of overhead or cove lighting, where the lamps are concealed within a hollow cornice; or else the lamps shed their light through a transparent ceiling so that there is a general diffusion without any small individual illuminant being presented to distract or annoy the eye and with a general absence of glare. This method of diffusing light has become very popular for large spaces. At the same time the electrical fixtures must always have a conspicuous place in the art of illumination, and these are made in greater quantity than ever, while increasing attention is paid to their finish and artistic design.

It is said that the first incandescent electric light fixture was made as early as 1842 by Mr. William Pearce, of Boston, Mass., for Mr. George Peabody, the banker and philanthropist, who was assisting in his electrical experiments an unfortunate young inventor named Starr, who anticipated much of the practical development of electrical illumination that did not come until nearly forty years later. It is said that this pioneer fixture had no fewer than 26 little lamps set in sockets, fashioned like ears of corn, symbolizing the then 26 states of the Union. The bulbs were of molded glass to imitate kernels, and the socket had leaves of sheet brass hammered into the likeness of cornshucks. Thus early it will be seen that the artistic value and adaptability of incandescent lamps was appreciated. The range of electric light fixtures is to-day so infinite that it is impossible to enumerate them all or to do more than characterize them. A good example is afforded by any new edifice, and for such purpose the new Federal building in Chicago will serve, the equipment there being of unusual size, providing for some 15,000 lamps. The first installation contained over 10,000 lamps of 16 candlepower, while the later development of studies with regard to the fixtures and the use of cove and concealed lighting has rendered possible the employment of lamps of 4, 8, and 10 candlepower, so that the present installation is the equivalent of 15,000 lamps of 8 candlepower. In order to permit the use of these lamps no fewer than 2,970 outlets in the building were furnished with electrical fixtures, which have been installed at an expense of about $50,000. In the main rotunda 900 lamps of various powers are employed, many of them in fixtures carrying a holophane globe, placed around galleries and corridors, and with 16-globe electroliers, which are hung at the first floor level, and at the face of the rotunda floor level 100 feet higher. The brackets or electrical fixtures for this purpose cost $400 each, and are constructed of cast brass, weighing 750 pounds each. The globes, 30 inches in diameter, are of leaded white ground glass illuminated with 12 ruby-colored 8-candlepower lamps inside and with a row of eighteen 8-candlepower white frosted lamps around the equator. The main vestibules, which are finished in granite, have 12 large fixtures of architectural design and generous proportions of the bracket type, each carrying a sandblasted globe which contains six 16-candlepower lamps. The stairways are further illuminated with massive newel post stands, while in the corridors and rooms are stalactite fixtures and a variety of other wall brackets and ceiling clusters harmonizing with the general treatment of the building.

Special treatment of this character will, in fact, be found in every large new building now erected, and in some instances the purpose of the building calls for novel fixtures, as, for example, those installed in the main dining room of a large new hotel in New York, where the fountains that play during mealtime are in the nature of electric fixtures with the lamps shining up from the base through the water.

Telephone apparatus.—Table 14 shows the number and value of telephones and telephone apparatus and supplies for 1905.

TABLE 14.—TELEPHONES AND TELEPHONE APPARATUS—NUMBER AND VALUE: 1905.

STATE.	Total value.	TELEPHONES. Transmitters. Number.	TELEPHONES. Transmitters. Value.	TELEPHONES. Receivers. Number.	TELEPHONES. Receivers. Value.	TELEPHONES. Complete sets of instruments, not included in transmitters and receivers. Number.	TELEPHONES. Complete sets of instruments, not included in transmitters and receivers. Value.	INTERIOR SYSTEMS COMPLETE WITHOUT INSTRUMENTS. Number.	INTERIOR SYSTEMS COMPLETE WITHOUT INSTRUMENTS. Value.	CENTRAL SWITCHBOARDS. Number.	CENTRAL SWITCHBOARDS. Value.	PRIVATE EXCHANGE BOARDS. Number.	PRIVATE EXCHANGE BOARDS. Value.	Telephone parts and supplies (value).
United States	$15,863,698	850,815	$824,204	831,195	$696,113	887,447	$6,483,418	4,560	$68,826	4,283	$5,154,447	3,917	$564,795	$2,071,895
Connecticut	129,215	(1)	(1)	(1)	(1)	(1)	(1)	....	....	(1)	(1)	(1)	(1)	129,215
Illinois	8,357,521	87,688	140,099	141,935	127,037	588,750	3,942,343	3,410	31,390	2,199	3,144,595	1,153	179,031	793,026
Indiana	490,157	(1)	(1)	(1)	(1)	34,370	334,170	....	....	[illegible]	105,387	(1)	(1)	50,600
Maryland	50,900	(1)	(1)	(1)	(1)	2,400	33,600	(1)	(1)	(1)	(1)	....	....	17,300
Massachusetts	264,487	(1)	(1)	(1)	(1)	5,860	53,520	(1)	(1)	(1)	(1)	....	....	210,967
Missouri	148,258	(1)	(1)	....	....	15,532	148,258	(1)	(1)	(1)	(1)	(1)	(1)	(1)
New Jersey	56,873	(1)	(1)	(1)	(1)	(1)	(1)	....	....	....	....	(1)	(1)	56,873
New York	4,165,653	649,627	572,365	554,935	457,970	104,180	982,834	209	5,305	776	1,695,709	2,194	331,042	120,428
Ohio	736,463	29,000	32,550	23,200	23,850	39,362	382,275	[illegible]	6,500	203	122,500	(1)	(1)	168,788
Pennsylvania	221,203	2,930	2,930	(1)	(1)	18,210	172,295	(1)	(1)	(1)	(1)	(1)	(1)	45,978
Wisconsin	130,515	(1)	(1)	(1)	(1)	10,218	130,515	....	....	(1)	(1)	(1)	(1)	(1)
All other states	1,112,453	[2] 81,570	[2] 76,260	[3] 111,125	[3] 87,256	[4] 68,565	[4] 303,608	[5] 856	[5] 25,631	[6] 777	[6] 86,256	[7] 570	[7] 54,722	[8] 478,720

1 Included in "all other states."
2 Includes states as follows: Connecticut, Georgia, Indiana, Maryland, Massachusetts, Michigan, Missouri, New Jersey, and Wisconsin.
3 Includes states as follows: Connecticut, Georgia, Indiana, Maryland, Massachusetts, Michigan, New Jersey, Pennsylvania, and Wisconsin.
4 Includes states as follows: California, Connecticut, Georgia, Michigan, New Jersey, and South Carolina.
5 Includes states as follows: Georgia, Maryland, Massachusetts, Missouri, and Pennsylvania.
6 Includes states as follows: California, Connecticut, Georgia, Maryland, Massachusetts, Missouri, Pennsylvania, Rhode Island, South Carolina, and Wisconsin.
7 Includes states as follows: California, Connecticut, Georgia, Indiana, Missouri, New Jersey, Ohio, Pennsylvania, South Carolina, and Wisconsin.
8 Includes states as follows: Alabama, California, Colorado, Georgia, Iowa, Michigan, Missouri, Nebraska, Oregon, Rhode Island, South Carolina, and Wisconsin.

The total value of telephonic apparatus manufactured, as reported at the census of 1905, had a value of $15,863,698, as compared with $10,512,412 for the census of 1900. These figures do not reveal all the facts, for during the period covered no greater activity was shown in any department of electrical application than in telephony. A very large proportion of other electrical apparatus, including dynamos, motors, motor-generator sets, insulated wires and cables, conduits, etc., were required for the equipment of telephone exchanges and in connecting the stations of individual telephone subscribers, and only an analysis of the product for these other fields, and an apportionment to the various branches of electricity, would bring out the high relative importance of telephonic development. As in the earlier figures of telephone manufacture, the value of products roughly divided itself in halves between the receiving and transmitting instruments, and the switchboards.

The value returned for the 4,283 central switchboards was $5,154,447, to which should be added the 3,917 private exchange boards of a value of $564,795, making a total of $5,719,242. To this should be added a large proportion of the value of $2,071,895 reported for telephonic parts and supplies. The subscribers' apparatus used in connection with these exchange boards and smaller equipments was reported as having a value of $8,003,735, of which $6,483,418 was represented by complete sets of transmitters and receivers. It will be noticed that individual transmitters and receivers, manufactured but not assembled into complete sets, very nearly balanced each other, as might have been expected, there being few uses for a telephone receiver when not associated with a transmitter, and vice versa. It will be observed also that the equipment within the central station exchange was broadly equivalent in value to that employed in the exterior equipment at the subscribers' stations, which according to this table would show a gross increase of about 1,700,000 subscribers during the year 1905. This sweeping assumption would not, however, be justified, for the reason that a great deal of apparatus is destroyed each year or becomes obsolete, so that the new simply replaces the old in a great many instances. No large fire occurred in any community—as at Baltimore or San Francisco—in which telephonic apparatus was destroyed in considerable quantities at the subscribers' stations; but even this diminution of apparatus already in use is perhaps not equal to that which is caused by the abolition of the older magneto-calling method and its substitution by the central energy system; it being necessary in the former case to signal the exchange by the manipulation of a little crank on the telephone set, while in the central energy or common battery system all that is necessary is to remove the receiver from the hook on the transmitter stand.

All the telephone exchange service of the country is furnished by the Bell system and by that which bears the general name of "Independent." The exchanges connected with the network of the American Telephone and Telegraph Company during 1905 reported an increase in the period of 441,734 stations. If it is to be allowed that the new connections to the independent systems proportionately equal this, it will follow that new equipment was called for by these subscribers to the amount of about 800,000 sets, which would indicate that about half the new apparatus manufactured goes to replace that which has been worn out, destroyed, or become obsolete. A certain amount, however, of

KEYBOARD CABLES FOR TELEPHONE EXCHANGE (SKELETON OF SWITCHBOARD SECTION IN THE REAR).

the telephonic apparatus made in the United States is exported; but the statistics of the manufactured exports do not give these figures in detail. A certain number of stations also are fitted up in connection with interior systems, but these in the aggregate are insignificant as compared with the central exchanges, for, while no fewer than 4,560 interior systems were returned, their value was only $68,826, from which it is evident that the number of stations connected—as, for example, on the different floors of a factory—would number but a few thousand at the most. It has been claimed that in recent years the number of independent telephone stations has increased more rapidly than the number of the Bell stations; but there are no exact data on the subject and the last figures available, namely, those of the Census report for 1902, gave a total of 1,317,178 Bell stations and 998,119 independent stations. There has been an enormous development of telephony in the great cities during the past five years, but at the same time one of the great features of telephonic increase has been the utilization of the telephone in rural districts, so that to-day no agricultural section of the country is without its village exchange and its farmers' lines.

The vital importance of the telephone system to the business and social life of the twentieth century may be shown by the fact that in 1905 the Bell system alone reported 4,532 exchanges in operation, 6,043,518 miles of wire in exchange and toll service, and 74,718 employees, with total exchange connections for the year of 4,360,996,000, or an average of nearly 14,000,000 per day. Even if the number of connections through the independent exchanges and networks should not equal this, it will be readily seen that an enormous amount of traffic in the nature of business, social, and family intercourse was transacted with the aid of the telephone, and indeed it would be impossible to imagine the conduct of American life upon its present basis without the telephone.

Illinois is the great center of the telephonic manufacturing industry in the United States, both as to number of factories and as to output. As shown in Table 14, this state accounts for more than half of the total value of product. It reports, for example, 588,750 complete sets of instruments, at a value of $3,942,343; 2,199 central switchboards, valued at $3,144,595; 1,153 private exchange boards, at a value of $179,031; and telephone parts and supplies, to the value of $793,026. The product in New York state was also quite large, although far below the aggregate in Illinois; the value reported for 104,180 complete sets of instruments being $982,834, and $1,695,709 for 776 central switchboards. It also had the largest proportion of the private exchange boards, numbering 2,194 and valued at $331,042. Both in Indiana and Ohio there was a fairly large production of apparatus, Indiana reporting 34,370 complete sets of instruments, valued at $334,170, and 328 central switchboards, valued at $105,387. The product in Ohio was about the same in quantity and amount, namely, 39,362 complete sets of instruments, valued at $382,275, and 203 central switchboards, valued at $122,500. Michigan and Massachusetts came next to Illinois in the manufacture of miscellaneous telephone parts and supplies, the output in Massachusetts being $210,967, while that of Michigan can not be shown separately. The product in the factories devoted to telephone parts and supplies is somewhat analogous to that in the bicycle and automobile field, these smaller factories chiefly making pieces which afterwards would be assembled into completed apparatus in the larger factories.

The telephone switchboards enumerated in this report are of two main classes—manual and automatic—which subdivide themselves into a great many varieties. The manual switchboard is that in which the connections between the subscribers are made at the central exchange by operators, who connect the lines of the different subscribers at the board by means of plugs joined by flexible conductors, all such connections being made in accordance with requests received over the line from the calling subscribers. These manual boards constitute a very large proportion of the boards included in the present statistics. There were in 1902 no fewer than 10,842 manual boards in use, and while no detailed figures are given, it is the fact that nearly all of the central switchboards and the private exchange boards made in the census year were also of the manual variety. This condition is likely from all appearances to continue for many years, although the automatic method has of late exhibited a rapid increase. During the past year fewer of the manual boards constructed were of the magneto type—in which each subscriber's substation has a small battery to energize its transmitter, and a tiny magneto-generator in the bell box, by revolving the handle of which the subscriber signals the central exchange. For all large boards of the manual type, as well as for a growing number of the smaller ones, the common battery system is in increasing favor, and in 1905 no new large exchange equipment in the United States can be named which was not of the latter type. In the common battery system, aside from the concentration of the source of all the electrical energy for the system at the central office there is another general feature which distinguishes it sharply from the older magneto-system. The signals on magneto-switchboards are of the electro-magnetic drop character, which operates in such a manner that when the current comes in from the subscriber's line, the drop or shutter corresponding to his line and carrying a number is dropped or otherwise moved, thus exposing the figures of the drop to the operator, who thereupon ascertains the wishes of the subscriber and connects him with the required circuit. The visual drop has long been con-

sidered inadequate to the needs of modern telephony, because the operator often fails to notice the falling shutter, and also because the shutter mechanism requires relatively so much space. In all the new large boards associated with the common battery practice the lamp signals are used, consisting of a very small incandescent lamp which flashes into visibility the moment the subscriber removes his receiver from the instrument at his office. When several thousand subscribers have to be represented and interconnected in the limited space of a multiple switchboard, the advantages of such signals are apparent, as they are extremely compact and hence economize space; having no working parts, they can be placed in any position vertically, horizontally, or at any angle; moreover, they are automatic in action, so that the signal disappears immediately when the energizing current is cut off. They also give a much more positive and attention compelling signal than any other form of indicator that has yet been tried in telephone practice. To quote the language of Mr. Herbert Laws Webb:

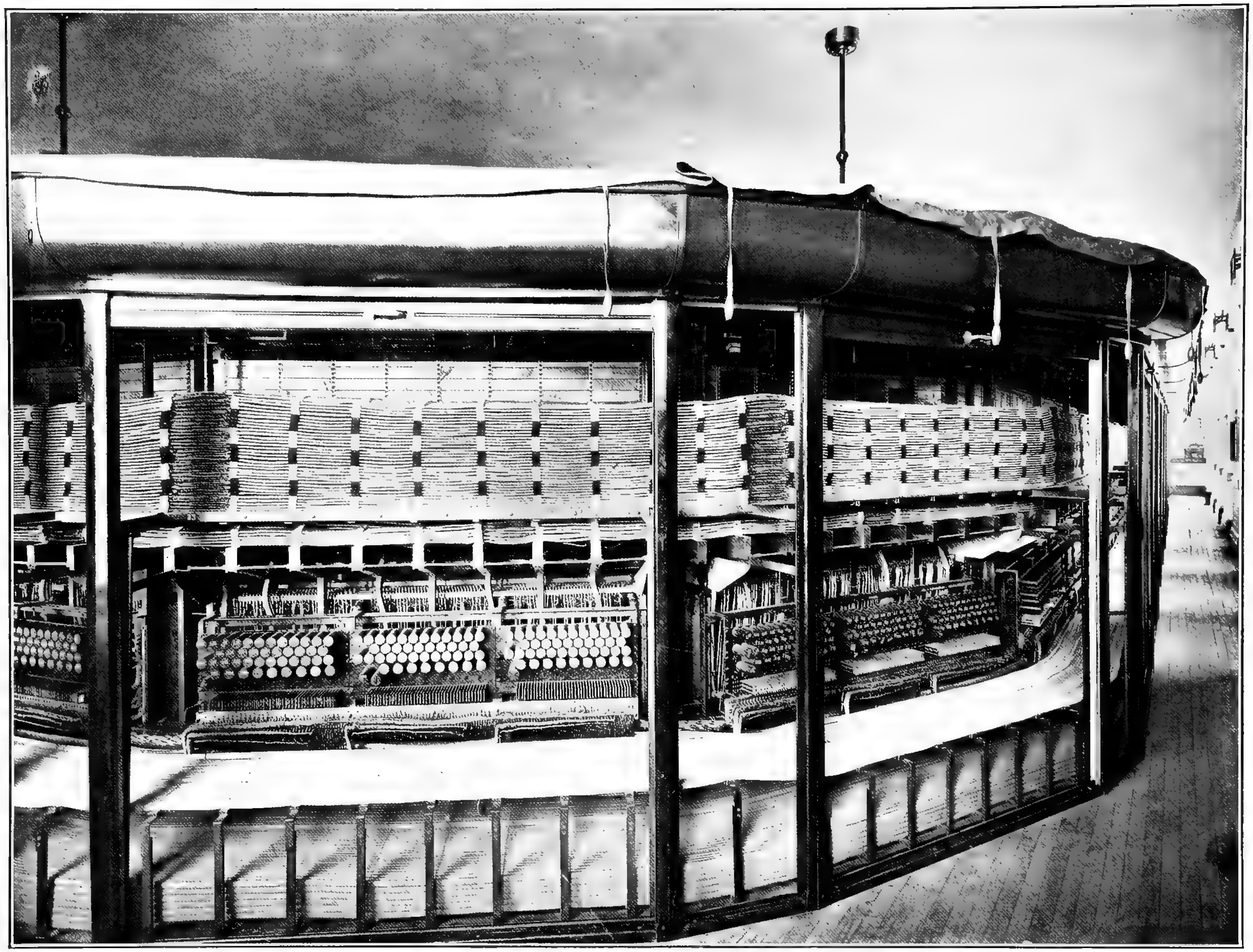
> These various qualities enable several radical improvements to be made. The signals are placed immediately adjacent to the jacks or cords they control, which, in large switchboards, is impossible with electro-magnetic indicators; the line lamp is immediately above or below its corresponding answering jack and the supervisory lamps are in line with the connecting cords and close to them. With this arrangement the operator loses no time and has to exert no brain power in tracing the relation between the signal and its corresponding jack or cord. The difference in effect between the modern arrangement of directly associating the signals with their corresponding jacks and cords and the old arrangement of placing the signals in a separate part of the board from that occupied by the jacks and cords is something akin to the difference between a telegram in plain language and one in code. In the one case the meaning of the signal flashes instantly to the brain of the operator, and in the other case a certain effort, and a certain interval of time, are required for translating the meaning of the signal. The automatic working of lamp signals is of much wider range than that of electro-magnetic signals. We had self-effacing, or automatically restored indicators before lamp signals were introduced. But the self-restoring indicator had but two positions—only two words in its vocabulary, so to speak. The lamp signal has several; it may be alight or out, corresponding to the down and up positions of the indicator, but it may also flash, and it may be made to flash at different rates of speed, easily recognizable. Therefore, apart altogether from the fact that it is much more easy to apply to lamps distinctive marks indicating different classes of service than it is to apply such marks to indicators, the lamp signal is able to convey a greater number of meanings as a working signal than an indicator. Finally, the more assertive and positive signal given by a lamp as compared with an indicator is due to a simple physical fact—the great sensitiveness of the eye to light. The glowing of a lamp signal instantly attracts attention, no matter at what angle the lamp may be relative to the eye, and in many cases the lamp is seen instantaneously where a fallen drop would be unnoticed for several seconds. The lamp is seen out of the corner of the eye, so to speak, whereas an indicator must be more directly in the range of vision.

Mention has also been made of the fact that in the telephone switchboard of the modern common battery type the distributed battery, so to speak, that was formerly located in individual cells at every subscriber's station is now all centralized at headquarters, where it is far more available for inspection, renewal, maintenance, and continuous operation. The primary batteries that were formerly in use, scattered widely over a large territory, were subject to all kinds of accidents and interruptions from freezing, spilling of acids, corrosion, breakage of jars, etc.; whereas to-day the idle capital represented alike by the local battery and the magneto-generator with its incidental expenses, is done away with, and a large source of electrical energy is substituted, which stands ready at the central office to be drawn upon freely at any instant by any subscriber.

The work of the common battery office is performed with the aid of the storage battery, and the majority of such installations are operated at a potential of 24 volts, requiring a minimum battery of 12 cells. In most instances a duplicate of adequate capacity is installed and is associated with more than one method of generating, so that the services may be rendered free from all danger or possibility of interruption. It is stated that owing to the lessening of labor the operator, by these modern methods of signaling in common battery systems, can handle with success an average of about twice as many subscribers as with the old system. Another feature of this work has been the division of an exchange into virtually two sections to facilitate the transfer of communication at junctions from one circuit to another, the existence of supervisory lamps on the board enabling the incoming checking operators to signal back automatically to the answering operators whether the lines wanted are engaged or disengaged or out of order—the aim of this being to lessen the amount of trouble due to "line busy" or "engaged" difficulties that were the bugbear of all exchanges and the annoyance of all subscribers.

There is necessarily a great deal of complexity still about the modern common battery switchboard, but some of the gains resulting from its use are indicated in the striking statement that in a large exchange a room which formerly contained a magneto-switchboard equipment for 5,200 subscribers' lines, now contains a switchboard equipment of modern apparatus with lamp signals, which has a capacity of 9,600 lines. Moreover, the gain in time, due to the shortening up of the period necessary for connecting and disconnecting subscribers, adds greatly to the traffic-carrying capacity of equal plants under the two systems.

The other general class of switchboards included in this report is the automatic, in which all manual operations, whether of the magneto-exchange or the common battery system, are dispensed with, and all the operations of connecting and disconnecting are performed by automatic mechanisms at the central station set into motion by the subscriber himself. The subscriber's station consists of the usual telephone transmitter, receiver, battery, bells, induction coil, etc., with the addition of a call dial placed just below the



TELEPHONE SWITCHBOARD, SHOWING REAR VIEW OF SUBSCRIBERS' SECTIONS, WITH MULTIPLE CABLES, ANSWERING JACK CABLES, CORD CIRCUIT CABLES, AND RELAYS.

transmitter, on the periphery of which are ten numbered finger holes, carrying the numerals 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0. When the subscriber wishes to call a number, he takes the receiver down and moves the dial around successively step by step to the separate numerals constituting the number, when having completed the number he presses a button beneath the dial and rings at once the bell of the other subscriber called. If the line required is free, the connection is completed. If the line required happens to be busy, a buzzing sound in the receiver of the calling subscriber informs him that such is the case, whereupon he waits until the other line is clear. This step-by-step mechanism is simple and ingenious and works satisfactorily. For exchange purposes of the automatic system two classes of switches are employed. One set is known as the "selectors," of which there is one for each telephone connected with the central exchange; and the other is spoken of as "connectors," of which there are ten for every one hundred selectors, and which are in groups, each capable of connecting a hundred telephones. The selector connects its calling telephone with the connector in the proper group, which in turn connects with the required telephone in the group to which the connector belongs. This is employed in the case of exchanges of 1,000-line capacity or less. In larger exchanges a second auxiliary selector is employed, in the nature of an intermediate switch, which divides the work of selection with the first selector and therefore facilitates the work. These automatic switches at the exchange are mounted on steel shelves, 25 to the shelf, each board carrying four shelves of the first selectors and one shelf of the connector switches. This typical arrangement for central exchanges of 1,000 lines is modified in larger exchanges up to say 10,000 lines, where the board is made up of six shelves, four carrying the first selectors, one carrying second selectors, and one carrying the connector switches. The floor space occupied by such a condensed switchboard is 11 feet 6 inches by 12 inches in depth, and these boards or exchanges can be readily increased by simply adding new sections with the desired number of switches mounted thereon, without the disturbance of the board or the exchange already at work.

The system of trunking cables is similar to that in manual practice, and the selection of the trunk is automatically accomplished by means of the "wiping fingers" on the shaft of the selector switches, which pass over all the busy contacts and stop at the first idle point. The electrical equipment in the operation of the system follows generally the lines of the standard manual exchange, and consists of a 52-volt storage battery for furnishing current; and there are, as usual, cross-connecting boards or distributing racks, equipped with heat coils and carbon lightning arresters; a ringing machine, with "busy back" and "howler" attachments; a "telltale" board for the location of trouble; and the usual accessories of a small power plant.

The telephone switchboard is an exception to many other forms of construction, in that the cost per unit increases at a greater ratio than that of the mere physical enlargement of the board and of the system. The cost of a switchboard, in fact, ranges from $500 to $1,000 per square foot, varying according to the number of wires accommodated, while the life of the board is comparatively short. The system in New York city, for example, has practically been rebuilt three times in sixteen years, owing to the radical improvements made in switchboard systems and in the trunking cables, each time involving the abandonment of the then existing plant. Some of these exchanges have, in fact, been rebuilt three times in a little over ten years, showing an actual depreciation of 25 per cent per annum, although the old plant was not physically unserviceable. In a small switchboard with sections or places for two operators, there would be two sets of circuit branches and sockets for each telephone line, so arranged that the operator can make connection by plugging into them. In a large switchboard, however, with places for 50 operators there must be 50 sets of such connections for each telephone line—the number of this class of connections multiplying twenty-five times for each telephone, in order to enable each operator to reach all the subscribers who are connected into that central switchboard. The difference in cost of manufacture is immediately brought out by noting the material thus entering into the composition of a small switchboard of 600 telephones and one for 10,000 telephones, the individual items and details in each being alike and of the same cost. In the smaller switchboard there are only 43,000 soldered connections for the circuits, or about 72 to each telephone. In the larger switchboards, however, there are no fewer than 2,500,000 soldered connections, or 250 to each telephone. In the smaller board there is the quantity of 220 miles of wire circuit, or about one-third of a mile to each telephone. This in itself is very often as much wire inside the exchange for the subscriber as there is outside connecting his station with the exchange. In the larger switchboard, however, there are no less than 10,000 miles of wire, or at least 1 mile to each telephone. The other details follow in similar proportion, so that the whole expense per telephone is vastly greater in the larger boards, no matter what refinements or economies are introduced in the process of manufacture. Hence, as an actual fact, the cost of the largest boards will sometimes reach as much as $1,200 per foot of length, while one-third of the gross revenue of a telephone company is necessary to maintain such a board and the plant in good order without any reference to the cost of operation or of extensions.

As the statistics show, no fewer than 3,917 private

exchange boards were built during 1905. No such boards were enumerated separately at the census of 1900, although a number of them were in use, and it is probable that boards of this type were included in the class of "interior systems" at that census, as the distinction between these two classes of boards had not been clearly defined at that time. On June 1, 1905, there were as many as 6,637 private branch exchanges in Manhattan and the Bronx boroughs of New York city, with 17,704 central office lines furnishing service for 67,176 stations. The installations of this character vary from those with one or two lines or stations up to such large systems as that in a leading hotel with 1,200 telephones, or in a large dry goods store with 2,000. These private exchange boards are manufactured for many special uses and the advantages of their employment have been so great that the number of operators employed on the private exchange boards in New York city alone is more than twice the number of the operators in the central exchanges there. This concentration of lines from the individual telephones in business establishments to a single desk, where the desired interior and exterior connections can be made, has in reality done much to limit the size of the central switchboards themselves, as it is obvious that if every circuit were brought out to a central exchange, the boards would be of even more unwieldy proportions than they are now, while the outlook for the future would involve problems in switchboard construction with which no known resources of the art could grapple.

Including the separate transmitters and receivers, it would appear that a total of about 1,700,000 complete sets of telephonic substation instruments—that is, each set comprising a receiver and a transmitter—were manufactured in 1905, giving an average value of about $4.75 for each set, the total value being in excess of $8,000,000. The transmitters and receivers are of a great many different styles of construction, but all of them are essentially of the same nature in the two classes of apparatus, the differences being mainly such as might be expected where a number of manufacturers are endeavoring to give individuality to their products. All the transmitters now manufactured in the United States are of the microphone type, including the single contact, the multiple contact electrode, and the granular carbon varieties.

The prevailing theory as to the action in the transmitter is that as the pressure between the carbon electrodes or particles increases, the area of the contact increases so that it becomes denser, and is a better conductor. In the single-contact transmitters the resistance of the circuit is varied between two points forming a single contact. In the multiple electrode transmitter a number of pieces of carbon points, blocks, or balls are brought into contact. Several such transmitters were at one time in use, particularly for the purpose of long-distance work where a heavier volume of current was deemed necessary. However, few, if any, of these are now made, the prevalent and predominant type being that of the granular carbon. In this class of apparatus carbon particles are used, as practically all forms of this are variations of the original White "solid back." The carbon particles now most favored are made from anthracite coal, the minute pieces of which are highly polished and are selected according to their degree of hardness. These particles are sifted through sieves having about 50 to 55 meshes per inch, and the average size of these particles is from 0.020 to 0.022 inch along the direction of the greatest dimension, although some particles in use are considerably larger. Great pains are taken to secure particles of a uniform grade, as in this way the effect of "packing" is greatly reduced. Unless these particles are of uniform size they naturally have a tendency to pack or to settle down into a compact mass, and the more solidified the carbon becomes the less readily can the current flowing in the transmitter circuit be made to fluctuate, according to the variations of the diaphragm caused by the sound waves directed against it by the voice. These granules of carbon are inclosed in a shell or casing between a front and back electrode of carbon. The vibration of the diaphragm, being communicated directly to the front electrode, varies the pressure and distance between it and the back electrode. The movement of the diaphragm is in some of these instruments dampened by springs which prevent too great amplitude of its vibration. The carbon working parts are inclosed in cups of brass, aluminum, etc. This again is usually inclosed in an outer receptacle or two-piece cup of metal, the two parts being permanently riveted or secured together so that the working parts can not be tampered with. A hard rubber flaring mouthpiece is placed in front of the speaking orifice of the transmitter, and the back is mounted upon a stand with swivel to permit its being raised or lowered in adjustment to the mouth of the speaker. The transmitter and the receiver are mounted together, either as desk sets or as wall sets. In the wall set the induction coil which is employed in the transmitter circuit is often placed in the base of the arm carrying the transmitter itself. It is also sometimes mounted upon the backboard of the telephone box. The base and arm are made of cast iron joined in such a manner as to permit of considerable vertical movement of the transmitter, so as to accommodate it to the height of the different speakers.

The induction coils are constructed and mounted in various manners by different manufacturers. In one approved type the core consists of a small bundle of fine Swedish iron wire. The primary is mounted over this, consisting of three layers of cotton covered wire. The secondary coil is mounted in two sections, bare wire being employed and the adjacent convolutions being kept apart by means of a fine thread of silk

wound alongside and parallel with the wire. Between each layer of wire a layer of paper is inserted in the process of manufacturing, so as to make the insulation complete. The machinery for the manufacture of coils in this manner is so ingenious that several coils can be wound simultaneously, the layers of paper being introduced automatically between each layer of the winding without any stoppage of the machinery, which is operated at very high speed. The use of the bare wire tends to cheapen the process of manufacture, as compared with the use of insulated wire. After the secondary windings have been finished the outside of the whole coil is usually covered with black cloth or other waterproof material, or else shellacked or varnished. The terminals of the coils are brought out to clips on the base, so as to serve as binding posts for connecting into the circuit, and they are numbered or lettered for purposes of identification in subsequent use. To give an idea of the amount of wire employed in each little coil, it may be mentioned that the winding of such coils for local battery use consists generally of about 150 turns of No. 22 wire for the primary and 6 layers of 6,000 turns of No. 36 wire for the secondary. It is by means of these induction coils that the feeble currents set up by the voice are so intensified that they are enabled to traverse long distances and overcome the resistance of many miles of transmission line without such loss as would impair them or render the undulatory current incapable of repeating successfully the operation in the receiver at the distant end.

Telephonic receivers as a general thing have varied little in outward appearance in several years, and some forms go back with little change to the original "butter stamp" adopted in the earliest years of the art. The receivers as now made consist essentially of an inclosed shell of hard rubber within which is a magnet, at the diaphragm end of which is a coil of fine wire, this solenoid consisting of very fine silk insulated copper wire wound on a spool. At one time most of the receivers employed in the United States were of the single pole magnet type, but the great majority are now of what is known as the bipolar type, the diaphragm end of the magnet carrying two solenoids instead of one, with the object of securing greater sensitiveness. In all the earlier instruments, and in many of those still in use, the binding posts of the receiver were exposed and exterior to the hard rubber shell, but in a great many of the instruments now the posts and connecting cords are carried within the shell, so that they are not so liable to work loose, and thus avoid the liability of dangerous contact on the part of the user should the incoming line be suddenly charged with "sneak" currents from railway or lighting circuits or from lightning. The troubles in the earlier type of receivers from the unequal expansion between the metal and the rubber parts are now hardly ever encountered, owing to the improvements in manufacture. The diaphragm of the receivers consists usually of very thin sheet metal vibrating in front of the magnets, and the diaphragms are either tinned or lacquered on the sides exposed to the breath to prevent corrosion from the moisture condensing on them.

For the use of all who must listen to the receiver continuously, as do the operators in the central exchanges, special receivers are made up in what is known as "watch case" or "head" form to be held to the ear by a flexible headband. Here the permanent magnets in front of which the diaphragm vibrates are of the ring type, being closed magnets, so as to produce poles on the opposite sides of their circumference. Fastened to the compound ring magnet are circular pole pieces which carry the electro-magnetic coils. The face of these pole pieces is closely adjacent to the diaphragm, as in the ordinary butter stamp receiver. The working parts are mounted in a hard rubber cap or shell and the diaphragm is clamped between the front face of the cup and the flattened ear piece, while the binding posts to which the terminals of the cord are attached are usually carried within the shell. Some forms of the watch case receiver are made up also for various uses where the employment of the longer receiver would be inconvenient.

It has already been noted that a considerable proportion of the manufactures in the telephone class were of parts and supplies, the total amounting to $2,071,895. This classification embraces a wide variety of parts, the chief items being the signaling apparatus in magneto-telephone sets and the line protectors, fuses, etc. Each magneto substation carries a pair of small gongs, between which swings a striker, forming part of an electro-magnetic system, so that the movements of the striker cause the bell to ring. The magneto generator included in the set is in reality a tiny alternating current dynamo which is operated by hand, so that when the crank is turned its armature is revolved rapidly and an alternating current is sent out over the line circuit to the central office to throw the subscriber's numbered drop on the switchboard. The substation is safeguarded against abnormal current by means of a protector placed on the backboard of the telephone set, a common form being a spark gap which consists of a pair of carbon plates, one of which is grounded, while the other is connected to the line, the plates being separated by a thin perforated mica washer. This is usually associated with a fuse or heat coil of fine fusible wire, which sometimes takes the shape of a tubular fuse, the wire being inclosed in a hermetically sealed small tube, which protects the fuse from the air and enables it to operate more uniformly. The tubular fuses are, however, used more particularly in connection with the protection of switchboards, being mounted in sets or gangs ready for insertion on the distributing board at the central exchange. In the present report fuses and lightning

arresters are as a class brought to account under a separate heading, and it is likely that many intended for telephonic use are there enumerated rather than as telephonic parts and supplies.

It will be readily understood that quite outside of the main switchboards and the apparatus in use at the subscribers' stations there is a large amount of miscellaneous apparatus which is included in "telephonic parts and supplies," and some of which even falls into other classes of manufacture. Each exchange, for example, in addition to its local and toll-line boards, is equipped with intermediate distributing frames or boards equipped with connectors to which the outside circuits are brought, so that they may be readily connected to or disconnected from the circuits within the exchange. In the case of the common battery systems there are also relay frames equipped with mounting strips for insulating individually each set of line relays, these being encased in dust proof caps or jackets. A central exchange is also provided with desks for the chief operator and the monitors and wire chiefs, each of these desks being thoroughly equipped for the supervision of the work within the exchange by the superintending force or for testing apparatus or lines immediately when any trouble arises on the circuits. The details that must be supplied in connection with ordinary interior telephone systems, intercommunicating systems, or those for simple intercommunication, are numerous also.

For many years past it has been the custom to employ the telephone for the transmission of music, sermons, speeches, etc., sensitive transmitters for this purpose being placed in the vicinity of the stage, the pulpit, or the musical performers. Separate companies have been organized for business of this character, while in Budapest, Hungary, a news system has been associated with such work. A more radical innovation or employment of the telephone owes its origin to Dr. Thaddeus Cahill, of Holyoke, Mass., who has developed within the last few years a most original and ingenious system of music production, and its distribution, by means of electrical currents over the telephone circuits. The principle of the invention is that each current of electricity from an alternating current dynamo has its own specific predetermined rate of vibration or frequency in the circuit, and that this current when brought to a telephone is there heard as a musical note. Middle C string on the piano, for example, has 256 vibrations per second, and in like manner the vibrations of current produced by the dynamo designed for that purpose number 256, and are heard as the same note in the telephone. The inventor has designed, therefore, and placed together on a common shaft 145 small alternating current dynamos, each with its characteristic current vibration, and these currents led to a keyboard can be manipulated there by the performer who, with the aid of the various transformers, or "tone mixers," is enabled to give a musical performance based wholly upon the current of these dynamos instead of upon the vibrations due to the use of reeds, strings, or pipes. The keyboard is operated by the performers just as is that of the piano or organ, or can be associated with a mechanical attachment, as in the pianola. The performers, having control of the dynamos, give not only the fundamental notes, but also the overtones or harmonics by compounding the various vibrations in such a manner as to play any chosen piece of music, and can also stamp on the sounds the quality of those from various musical instruments, such as the organ, violin, flute, etc. The plant where these electrical vibrations are generated can be connected with a large number of telephone receivers in different parts of a city, and hence the same music can be heard, simultaneously, at points miles apart. The electrical vibrations, with negligible loss in transmission, become music as soon as heard in the receiving telephone, to which is attached a megaphone horn in order to intensify the sound and enable it to be heard by several persons at once. It will be understood that these currents usually produce music only in the telephone receiver, but they can also be made audible as music in the "flame" of an electric arc lamp.

The telephone receivers and the horns attached can be exposed in full view of the audience, but are preferably inclosed or concealed in baskets of flowers, divans, ornamental urns, newel posts, etc., according to the nature of the room in which the music is to be rendered. Each receiving telephone requires a surprisingly small quantity of current for the delivery of music and a score of them will take no more than an ordinary incandescent lamp. The first commercial plant installed in New York city driven by a motor of 200 horsepower has an estimated capacity of from 15,000 to 20,000 subscribers, each furnished with a telephone that can be heard by a large audience. The music has been transmitted from the original plant at Holyoke, Mass., as far as Springfield, Mass., and New Haven, Conn., with success, but it is intended that each "central" shall be restricted to local delivery of its music. In addition to the large sets of apparatus for central station music purposes, the owners of the patents are manufacturing smaller isolated plants intended for separate use, and giving music, as desired by the individual performer, in exactly the same manner as an isolated light and power plant.

An ingenious piece of apparatus which has been introduced within the past year or two for use in connection with the telephone is the Poulsen telegraphone, the object of which is to furnish a record of the speech received over the telephone. Dispute often arises as to the exact nature of telephone conversations, and litigations have arisen on account of the discrepancy between the alleged statements of the interlocutors.

In the telegraphone the principle employed is that of recording upon a narrow traveling steel strip, or fine wire, the message or speech as received. As now manufactured and actually in use, the telegraphone embodies two large spools mounted on top of a small box which is equipped with an ordinary telephone transmitter and a pair of telephone receivers. From one spool to the other, standing 6 inches apart, runs a steel wire $\frac{1}{100}$ inch in diameter. Standing between the spools, on a vertical support or arm, are two small electro-magnets facing each other, about $\frac{1}{16}$ inch apart. When the conversation is going on, the magnets are switched into circuit, the wire is set in motion between the two spools, running from one to the other, and the vibrations of the voice as received from the distant transmitter are communicated electrically to the magnet coils. As the wire travels between the magnets it becomes magnetized with an intensity and a polarity corresponding to the strength of the particular sound vibrations, which correspond to the waves of electric current at that instant. When the conversation is finished, and the record is therefore complete, the spools are reversed and the wire reeled back. When it is required to listen to the conversation or to the message which has been taken by the telegraphone during a man's absence from his office, the receiver is put into circuit with the magnets and the wire is once more reeled off from one spool to the other. The magnets and the magnetic wire now act in such a manner that the coils are electrified, strongly or weakly, just as they were under the influence of the original undulatory waves of current created by the voice vibrations. In this manner the varying vibrations stamped magnetically on the traveling wire are communicated by it to the receiver and the conversation or message is reproduced by the receiver. The wire travels at the rate of about 10 feet per second. In addition to serving as a record for telephonic messages, the telegraphone is made to do also the work of a phonograph for receiving dictation; the wire with the dictation being run through again afterwards by the typewriter, who places the receiver to her ear for the purpose. In this manner a large amount of dictation or correspondence is provided for, as there are about 2 miles of wire on each spool. Another feature of the apparatus is that the reversal of the apparatus so as to secure the record cleans the steel wire of the record it has received. The passing of the wire before the electro-magnets "wipes off," so to speak, the magnetic impression which the wire had received originally. The whole apparatus has been developed into simple, compact form, and while not yet in extensive use, must be regarded as a part of the resources of the telephonic art available at the time of the present report.

During the past year or two submarine signaling based upon the use of the telephone has been introduced and a number of light-houses and steamships have been equipped with the system, which is of American origin, owing its perfection to Prof. Elisha Gray and Mr. Arthur Mundy, of Boston. The principle embodied is found in the fact that sound vibrations travel very easily in straight lines in the water—at about four times the speed that they do in air—and can be heard at a considerable distance if there is apparatus upon which the vibrations can impinge.

In the submarine telephone signaling apparatus now manufactured, a small tank is attached to the inner side of the skin of the vessel. This tank is filled with a chemical solution, denser than water, and contains a microphone. A sound reaching the ship's side through the water, passes into the solution in the iron tank and the vibrations impinge upon the sensitive microphone, acting as do the corresponding vibrations of the voice in the transmitter system of a talking circuit; from there the currents are carried to the receiving station in the pilot house, or other appropriate place, such as the ship's bridge, and are there heard by the telephone receiver. The receiving box is equipped with two telephone receivers instead of one. By holding first one receiver and then the other to his ear, the pilot, or navigating officer, can tell on which side of his vessel the submarine bell is located that is giving notice of danger, for the reason that the sound vibration travels in straight lines and therefore the direction can be very accurately determined. The same method applies to the indication of the location of two steamships during a fog, as both can tell the direction of travel and thus modify their course to prevent accident. In a report to the United States Navy Department, Lieutenant-Commander Walling has stated that the direction of a submarine bell can thus be determined by the telephone within one-eighth of a point on the mariner's compass. More definite data as to the commercial use of the invention are afforded by the fact that the signals of Nantucket, Fire Island, and Sandy Hook lights and light-ships have been picked up by approaching steamers from Europe at distances of 4 miles, the bell code numbers being known to the officers of the vessels. A great deal of work was done with the system during the year 1904–5, and at the time of the preparation of this report 19 light-ships on the Atlantic coast, about 125 steamships, and 2 American battle ships had submarine signal equipments. This American invention has also been introduced abroad and placed upon English, French, German, and Dutch light-ships.

A composite form of apparatus has recently been introduced, called the "telegraphone." It will be noticed that this name is somewhat confusing, as it has already been adopted for the Poulsen recording telephone apparatus previously described. This instrument is in all outward appearance similar to the

ordinary telephone, but it is not intended for telephonic use in the ordinary sense of the word. Through an adjustment of the railway telegraph circuits the apparatus can be attached to regular telegraph wires in such a manner that conversation, as well as the transmission of signals, can be carried on without interference by the calling devices with the Morse relays. The railroad telegraph apparatus can thus render double service; as the composite set avoids the cost of stringing an overhead circuit which is necessary when separate telephones are used by the railroads. It is stated that several hundred complete sets of this apparatus were manufactured during 1904. It should also be pointed out that simultaneous telegraphy and telephony over the same circuit has long been practiced in this country and in Europe, with methods and apparatus that are described in all the standard books dealing with the transmission of intelligence. The use of the telephone principle in railway telegraph signaling was also adopted by Mr. Edison several years ago in his well known "phonoplex."

Telegraph apparatus.—Table 15 shows the production of telegraph instruments, switchboards, and parts and supplies, reported in 1900 and 1905.

TABLE 15.—*Telegraph apparatus—number and value: 1905 and 1900.*

STATE.	Total value.	INTELLIGENCE (KEY, SOUNDER, ETC.).		Police, fire, district, and miscellaneous (value).	Wireless telegraph apparatus (value).	Switchboards, and parts and supplies (value).
		Number.	Value.			
United States, 1905..	$1,111,194	76,826	$187,744	$592,070	$114,050	$217,330
1900..	1,642,266	199,410	[1] 354,212	1,231,167	....	56,887
States, 1905:						
New York..............	412,106	24,756	96,339	145,438	8,500	161,829
All other states........	699,088	[2] 52,070	[2] 91,405	[3] 446,632	[4] 105,550	[5] 55,501

[1] Includes instruments to the value of $5,300, for which number was not reported.
[2] Includes states as follows: Illinois, Maryland, New Jersey, and Oregon.
[3] Includes states as follows: Illinois, Maryland, Massachusetts, Ohio, and Wisconsin.
[4] Includes states as follows: California, Colorado, District of Columbia, and Massachusetts.
[5] Includes states as follows: Maryland, Massachusetts, Missouri, Nebraska, New Jersey, and Wisconsin.

It will be noticed that there is an apparent falling off of at least half a million dollars in the value of telegraphic apparatus for 1905 as compared with 1900; the value in the earlier year being $1,642,266, whereas the last census year it was reported as only $1,111,194. This decline was perhaps more apparent than real, as in recent years the larger telegraph systems have shown an increasing disposition to make and repair their own apparatus rather than to purchase it from manufacturers in the open market. It is obvious that throughout the country the mere wear and tear on apparatus sending and receiving a hundred million messages a year, would require considerable outlay for renewals, even if no new offices were equipped. As a matter of fact, a large number of new telegraph offices of an extensive character have been equipped in recent years, calling for apparatus in quantities at least equal to those required at earlier periods in the art. To take a typical case, the Western Union telegraph system reported for the year 1904 the equipment of 338 new offices and no fewer than 356 in the year 1905, while during the two years referred to large offices were remodeled or reequipped at such important centers as Boston, Philadelphia, Cincinnati, Cleveland, and St. Louis. Moreover, in the year 1904 dynamo current was substituted for chemical cell main batteries in fifteen important centers of the same corporation, involving in the change extensive renewal, adjustment, and rearrangement of apparatus.

The newer apparatus in the telegraphic field includes that employed for what may be called high-speed printing purposes, intended to supplement or supersede the work of the manual operators who still transmit with the lever key the great bulk of American messages. The quantity of apparatus of this "machine" character manufactured is still quite small, but it would seem that the inventions in this field must result in making machine telegraphs play a conspicuous part in the telegraphic art. It has been said by one of the most prominent managers in the telegraphic field that the advances in the direction of developing and perfecting printing telegraph systems, adapted to all the requirements of modern service, leave no doubt as to the employment of such systems in the domain of commercial telegraphy. The most conspicuous systems of this character utilized to any degree in the United States are those of Buckingham, Rowland, Murray, and Delany.

In the Rowland system the basic principle is the employment of alternating current, which, dominant in the domain of light and power, is ideal also for the long distance transmission of intelligence. In order to transmit the signal, however, the alternating current is modified. For each signal the base, so to speak, is a block of alternating current, consisting of 11 half waves which are modified by the reversal of any two. In other words, the sending of signals is actually accomplished, not by supplying the line with current at the moment the signal is being transmitted, as in ordinary telegraphic methods, but by cutting out certain of the alternating current waves. Hence one or more of the signals can be made to consist of a combination of suppressed half waves, the signals so produced being then translated automatically into printed characters. In this manner, and by grouping the waves so as to permit of entirely different and independent signals being sent from four typewriter keyboards, each of the four transmitting operators employed can cut out four different wave combinations and thus send as many different signals over the line in a single second. Forty words per minute is given as a fair rate of speed for a practiced operator with this system, and as the system

can be duplexed, eight times that number, or 320 words in all, can be sent over a telegraph wire and printed in one minute. The late Prof. H. A. Rowland developed his system so that the letters of the alphabet, figures, and some extra signs are printed automatically in such a manner that each operator, by writing on the ordinary typewriter keyboard, prints on a page 8 inches wide at the other end of the line over which he is sending. These pages of printed matter have the general appearance of an ordinary sheet of typewritten matter, with the letters and figures appearing in clean cut block type.

In the Murray printing telegraph system the typewriter is again employed—the messages being mechanically both transmitted and recorded with it. Perforated paper tape is first prepared by means of a keyboard mechanism, the punches corresponding with letters and figures, and the tape is then passed through a Wheatstone transmitter, which, at a high rate of speed and operating automatically, sends out the signaling currents to the distant receiving station. These currents are utilized not to actuate the printing mechanism directly, as in the case of the other printing telegraph systems, but to produce a second perforating tape at the receiving end—this tape controlling mechanically a typewriter in the same manner as the perforated rolls of music operate mechanical pianos or organs. The Murray system affords a high rate of transmission on the wire and a high rate per operator, but is subject to the criticism that both the sending and the receiving stations employ a perforated tape, which in actual practice involves delay, especially in the case of errors or damaged tape. A maximum theoretical speed for the Murray apparatus working simplex is given of 96 words per minute and a practical speed of 120 messages of 30 words each per hour. Working duplex this system is credited with a theoretical speed of 192 words per minute and 240 messages per hour.

The Buckingham system is the first really rapid long distance page printing telegraph that has ever been introduced successfully, and it has been in use for a considerable period of time on some of the longest circuits in the United States. The distinguishing features of the invention consist again of a typewriter perforating apparatus for preparing the paper tape for transmission purposes, and the printing mechanism at the receiving end of the line. The perforated paper tape is run through the Wheatstone transmitter, which forwards the signals automatically to the distant receiving station; there they are received upon a Wheatstone relay and thence repeated into the local circuit mechanisms; these are of a novel and ingenious character, and so operate that the current distributing apparatus and the type wheels print messages upon regular telegraph blanks. These blanks encircle a tube, and when the printing of a message begins, one of them is slid edgewise upon a brass tube which serves as a support. When the blank has been printed, it is slipped off quickly to one side and a fresh blank takes its place. The message when thus printed is spread out by cutting it open, when it can be forwarded immediately to the addressee. The four-type wheels in the Buckingham system carry 32 characters, inclusive of the letters of the alphabet and punctuation marks, this special alphabet having been devised by Mr. Buckingham as adapted to the system. It is subject to the general objection of requiring a preliminary perforated tape, but on the other hand the messages received are printed ready for delivery, a notable point in total speed of transmission. In messages over Western Union circuits between New York, Chicago, or Buffalo, during six or seven years of operation, a working capacity of 200 messages per hour operating duplex has been noted. A modification of this system has been introduced in the Barclay method, which embodies a form of electrical typewriter of great sensibility and rapidity in action, and a comparatively simple printing mechanism so devised as to meet more fully the service requirements, and aiming at the same time to improve the legibility and general appearance of the printed message as sent out to the public. It is said that with the Barclay system a speed of at least 100 words per minute has been secured.

The Delany rapid telegraph system includes a perforator machine which may be operated by the ordinary Morse key at the highest speed of expert operators. With two such machines an automatic transmitter may be fed with perforated tape, and messages sent over the line at a rate up to the highest ability of the typewriter operator receiving at the distant end. Thus, with two perforating operators working at 20 words per minute, the automatic transmitter will deliver 40 words per minute in improved Morse to the receiving operator, so that the capacity of the circuit may be doubled, and a duplex become equal to quadruplex in output with six operators as against eight. The quadruplex wire may also be made to carry double the number of messages with twelve men doing the work of sixteen. The speed is limited only by the impulse-conveying efficiency of wires, or the delivery of impulses of sufficient power to make a mark with iron recording wire on the chemical tape by electrochemical action, permitting of ready transcription by the receiving operator, who has to translate the marks on the tape. The perforated message is made up entirely of dots, all impulses having the same time value, and each succeeding one being of opposite polarity to the one before it. The time between the positive marking impulses and the negative, cutting off, or spacing impulses determines whether the character is a dot or a dash in the Morse alphabet. As a matter of fact the perforator can be worked by an ordinary keyboard transmitter, so that any typewriter can perforate the sending tape without even knowing the Morse

alphabet. The receiving machinery is under the control of the transmitting operator, so that it may be stopped at any instant. The chemical receiving tape is only slightly damp and is wound up on wheels as it passes through the machine. It is not handled by anybody, being drawn in short lengths in front of the typewriter as the transcription is effected by means of a mechanical contrivance which is under the control of the typewriter's foot. It is stated that the transmitting apparatus is capable of running up to a speed of 10,000 words per minute, and that 8,000 words, or 2,500 impulses, a second have been recorded over an artificial circuit.

A great deal of time and attention has been devoted by inventors to the development of writing telegraph systems, and considerable ingenuity has been displayed in their manufacture. One system is in use in the United States at the time of this report and is being continuously developed. It depends, broadly, upon the principles of the parallelogram of forces, so that by compounding the movements of a point in two directions, one at an angle to the other, the actual path described by the point is the result of the two separate movements. In the telautograph, as thus worked out, the receiving pen operates under the variations of the magnetism of two electro-magnetic systems at right angles to each other, and reproduces with very close approximation the handwriting of the operator at the transmitting end in accordance with the motion of his pen or stylus. At the transmitting end a pencil is attached by rods to two lever arms which carry contact rollers at their ends, these rollers bearing against the surface of current carrying resistances connected with the sources of direct current supply. Hence the writing currents pass through the resistances to the rollers and thence to the line wires, so that as the stylus is moving in the act of writing the relation or position of the rollers in respect to the rheostats is constantly changing, and hence currents of varying strength are let through. Satisfactory operation is obtained with currents of a pressure from 80 to 250 volts, and the ordinary 115-volt current from incandescent lighting circuits is quite suitable. A master switch at the transmitter makes the necessary changes in the circuits and cuts out the mechanism when it is not in use. There is also a device for shifting the transmitter paper a distance of one line of ordinary writing, just as the paper is carried forward on a typewriter frame. The writing space is about 2 inches long and 5 inches wide, and allows for four or five lines of writing. When the sheet has been filled up, fresh paper is readily brought into position at the transmitter and with equal ease at the receiver. At the receiving end the apparatus for automatic writing is highly ingenious, particularly with regard to the supplying of ink and securing an easy, smooth movement of the transcribing pen. This apparatus has been introduced in the United States coast defence service for sending ballistic data from position-finding stations to the gunners. A special type of the telautograph has been manufactured for and adopted by the United States Signal Corps for fire-control communication. Commercial service is represented more specifically by its employment in hotels and clubs, communicating between restaurant and kitchen, for example.

Wireless telegraphy, since the last report on electrical manufacturing was made, has entered into such a sphere of importance and usefulness, both in peace and war, that its treatment has already become the subject of national and international control. Inventors in this field have been numerous, not only on both sides of the Atlantic but in South America and Japan, and the amount of wireless telegraph business now transacted is quite large, thousands of messages being daily transmitted through the ether, chiefly between ships and shore, but also between stations upon land. All of these wireless telegraph stations depend upon wire towers or antennae, carried high in the air in order to give off to, and to receive from, the ether the electrical impulses impressed upon it by the transmitting system. The wireless telegraph stations along seacoasts or on shipboard already number several hundred, and every navy and important line of commercial steamships has its complete system of wireless telegraph apparatus. The introduction of the system has already been carried so far that it has been put on board some of the larger boats of the American fishing fleets. The whole coast line of Europe is dotted with wireless telegraph stations, and a chain of stations also extends along considerable portions of the American coast as well as up the St. Lawrence river. The equipment of these systems with towers and high tension generating apparatus has developed a new field of manufacture, but only the figures of specific telegraph apparatus are embraced in the values given in this report under "telegraphy," including the special transmitters, receivers, coherers, keys, and other features. The generating plants for stations of high power with a "striking" radius of hundreds of miles are now equipped with alternating current generators and transformers of considerable horsepower. The distance of the message bears a fair ratio to the amount of electrical energy employed in sending out the high frequency impulses to the atmosphere.

The leading systems of the apparatus in use in the United States are the Marconi, the Slaby-Arco, the Braun, and one or two others of European origin; but there are several highly ingenious and successful American systems, notably those of Fessenden, De Forest, Massie, and Stone, all of which have been put into commercial operation. A principal element in the wireless telegraph systems is the device for intercepting the etheric impulses so as to convert them into signals. A leading type of coherer apparatus consists

of a small pencil-like glass tube filled with metallic filings, which are caused to cohere by the incoming impulses and which are usually made to decohere by means of a tapper in the local circuit. This little tube receives the successive impulses and records them with auxiliary appliances, or renders them audible in a telephone receiver. The coherer by its variations operates a very sensitive relay, with an ink-recording device, by means of which the message is registered in the Morse alphabet. Some of the coherer systems are automatic in their operation. The rate of signaling with the filings coherer is comparatively slow, being limited to about ten or fifteen words per minute, on account of the sluggishness and mechanical inertia of the various parts. The distance of operation with this coherer also seems to be somewhat limited. A typical autocoherer system is that which has a telephone receiver in circuit, the variations of the current producing sound in the telephone receiver of long or short variation, corresponding to dots and dashes of the telegraphic alphabet.

Another form of autocoherer, or detector, is that devised by Marconi, based upon the principle that electrical oscillations affect the magnetic changes in iron, enabling them to occur more rapidly. An endless belt of thin wire about 12 inches long revolves on a pulley operated by clockwork, and passes through a spool on which are wound two coils of fine wire. The outer wrapping or coil is part of a circuit in which is included a telephone receiver, while the inner coil of wire is connected in series with the vertical wire tower or antennae. Two horseshoe magnets having their like poles adjacent to each other are placed in proximity to these coils, and while normally the changes of the magnetism in the traveling wire in proximity to the magnets are not sufficiently rapid to set up currents in the coil, the conditions are different when rapid electrical oscillations occur in the inner coil, these being accompanied by correspondingly rapid momentary changes in the magnets of the traveling core or wrapping of thin wire. The consequently rapid variation of the magnetic lines, or field of force, in the traveling wire set up momentary currents that are detected or heard as sound in the telephone receiver. It appears that a speed of 25 or 30 words a minute can be obtained in practice with the detector, thus doubling the rapidity obtainable with the filings coherer.

Another form of receiving apparatus is the Fessenden detector, which consists of a small insulating vessel, wherein is placed a weak solution of nitric acid. Down into this solution penetrates for a short distance a very fine platinum wire, and another platinum wire enters the acid from the bottom of the vessel. This device, or detector, which is called a liquid barretter, is connected for receiving between the vertical wires, or antennae, and the ground. The principle embodied is that all the resistance in the conducting medium is concentrated within a short distance of the point where the fine platinum wire enters the acid. Hence all the temperature effects are local or take place inside a hemisphere of comparatively small radius. The heating effect of the small battery in the shunt circuit normally increases the resistance of that circuit, but the resistance is broken down by the incoming electrical oscillations, and the variations of the current strength due thereto are recognized, in the telephone receiver employed, as dots and dashes. According to Mr. Fessenden, the action of this detector is not electrolytic, but thermic. Apparatus of a similar character for wave detection has been employed in the De Forest system, the detector being a very fine wire extending into the liquid contained in a small cup, with another wire running through the base of the cup. The liquid in the cup is a slightly acidulated solution. The principle, according to Doctor De Forest, being that the action is electrolytic, the current from the small battery sets up a further electromotive force of polarization which the arriving oscillations disturb, thus securing the desired audible result in the telephone receiver.

A more recent and highly ingenious form of apparatus of De Forest invention is that known as the "audion." This receiver for wireless telegraphy consists of a low voltage incandescent lamp with carbon filament, connected to a source of current consisting of a battery of dry cells and a rheostat for varying the current at will. Within the bulb of the lamp are placed two platinum wings, one on each side of the filament. A second set of dry cells is connected between the positive end of the filament and the platinum, the latter being connected to the positive pole of the battery. When electrification is produced in the neighborhood of the incandescent filament, a positive leakage discharge current will pass from the platinum wings through the attenuated gas in the bulb to the filament, and the conductivity of the gas between the wings and the filament increases rapidly with the increase of the heating current through the filament. When the audion is connected, either inductively or conductively, in an oscillation circuit of a wireless telegraph receiver, it forms an extremely sensitive detector of ether or Hertzian waves, giving responses or indications in the telephone receiver several times louder than any other known form of wireless receiver subject to the same impulses. It is stated that the device is extremely selective in its behavior with reference to waves of different lengths, and can be closely tuned with the syntonizer. By regulating the heating current—the potential between the wings and the filament, or the distance between these—the audion is made to a great extent selective for itself to the received impulses. It gives no evidence of fatigue under any conditions of use, requiring no adjustment in the receiver, and needing no protection from the violent impulses of the transmitter at its own station, as com-

pared with the sensitiveness of the receivers of the electrolytic type, which are said to be completely upset by one such violent impulse unless protected by a shunting switch.

As will be noticed from Table 15, a large proportion of telegraphic apparatus in 1905—in fact, one-half, $592,070—is comprised under the head of "police, fire district, and miscellaneous." The miscellaneous telegraphs in this group are not numerous, but the other three classes are important and are in constant demand. During recent years there has not been much change in any of them, except in the association with the older forms of telephony, which is under trial in various cities for fire and police purposes. The district messenger box is still to be found in most large modern buildings, but no essential change has been made in its mechanism or in the variety of the calls that may be effected through it. Here again the telephone has had some influence, and in more than one modern form of district messenger box an attempt has been made to add the telephone to the apparatus as a means of increasing its efficiency. The general subject of municipal telegraphs, including fire and police systems, will be found treated in great detail in the special report issued by the Bureau of the Census, entitled "Telephones and Telegraphs: 1902."

Insulated wires and cables.—Table 16 gives the value of insulated wires and cables manufactured as reported in 1900 and 1905.

TABLE 16.—*Insulated wires and cables—value: 1905 and 1900.*

STATE.	Value.
United States, 1905	$34,519,699
1900	21,292,001
States, 1905:	
Connecticut	2,156,369
Illinois	3,666,313
Massachusetts	1,001,522
New Jersey	8,234,885
New York	10,911,897
Pennsylvania	2,885.052
Rhode Island	5,122,464
All other states[1]	541,197

[1] Includes states as follows: California, Indiana, New Hampshire, Ohio, Oregon, and Wisconsin.

A total value of $34,519,699 was returned for the production of insulated wires and cables by 61 factories during the census year 1905. The industry was well distributed throughout the country, being carried on in 13 different states. The chief center of the industry is New York, which, with 12 factories, reported an output valued at $10,911,897; New Jersey follows, with 7 factories and an output valued at $8,234,885; and Rhode Island is third with an output valued at $5,122,464. As will be noted these 3 Eastern states accounted for considerably more than half of the total output, and if the product of Connecticut, $2,156,369, be added, it will be seen that these 4 Eastern states accounted for more than five-sevenths of the whole output of the country. The two other states conspicuous in this line of work were Illinois and Pennsylvania, the former with an output of $3,666,313, and the latter with an output of $2,885,052. The entire production of the country is reported by value only, the sizes of wire being so numerous and the complexities of their manufacture into cables being so intricate that no definite figures could possibly be secured as to the length in feet or the quantity in pounds. Every branch of electrical industry requires large amounts of insulated wires and cables. Every telegraph office and telephone exchange employs large quantities of such wires and cables. Every house or factory or office building wired for electric lighting and power receives and distributes its current through insulated conductors. Every motor car is heavily cabled, while every dynamo and motor is built up with insulated wires and cables. Some idea of the consumption of this class of material in one field alone may be formed from the fact that at the close of the year 1905 the companies constituting the Bell telephone system had in use not less than 320,000,000 pounds of copper wire, which would represent a value of copper alone of about $60,000,000. This copper is largely made up into cables of a permanent type, carried upon no fewer than 8,000,000 poles, and through 95,000,000 duct feet of underground conduit. An equally impressive idea of the consumption of cable is afforded by the fact that the electric zone of the New York Central and Hudson River Railroad has in its transmission circuits 1,500,000 pounds of copper in cables, and for the transmission and subsequent distribution from the substations a total weight of 3,000,000 pounds of cable, a large proportion of which is heavily insulated. In this electric zone there are 16 miles of cable conduit, 97 miles of cable in the conduits, 344 miles of cable upon poles, 3 cable towers, and 383 splicing chambers, where the short lengths of cable are united and made continuous throughout the system. Another striking fact is that a single telephone switchboard of the large modern type contains as much as 10,000 miles of insulated wire.

Underground cables in the field of electric lighting and power work are manufactured in three main classes: High tension, multiple, or single conductor cables of relatively small current carrying capacity, for operation under working pressures of from 2,500 to 25,000 volts; low tension single conductor cables of large current carrying capacity, operating under electric motive force of about 650 volts or less; and return cables of large current carrying capacity, but operating only under a pressure corresponding to the voltage "drop" in the return feeders. The third class has hitherto received little attention, and, in fact, bare copper cable has generally been installed, but the desirability of the use of insulated cables of this class has been approved and recognized in the last few years. High tension cables of the first class have developed

from the stage where merely rubber was used for insulation up to the time of the present report, when rubber, varnished cambric, saturated tape, and paper insulation have all been brought to a high state of perfection for this work. Rubber is used only where local conditions seem to demand an insulation that is impervious to moisture, so that in case the outer protected lead sheath should be punctured the cable itself need not necessarily fail. The superintendent of motive power of the Interborough Rapid Transit Company, of New York city, points out that where cables have to be installed in conduits that are under water part of the time or on the beds of rivers, etc., the extra investment for the more costly rubber insulation is justified, since in case of a leak in a submarine or submerged cable lead sheath it usually becomes a total loss if insulated with paper or non-moisture proof material, whereas good rubber lasts indefinitely under water. For pressures above 22,000 volts some form of varnished cambric or impregnated cloth is preferred in place of paper, owing to its higher resistance to puncture for a given thickness. Conservative practice in cable manufacture with paper insulation for standard working pressure of 3,000 volts requires on a cable ranging from No. 000 to 300,000 circular mils a paper insulation thickness of $\frac{6}{32}$ inch, with $\frac{7}{64}$ inch thickness of lead in a single conductor cable up to $\frac{9}{64}$ inch in a three-conductor cable. In heavier cables with paper insulation, as, for example, 1,250,000 to 2,000,000 circular mils, with the same working pressure of 3,000 volts, good practice requires an insulation of paper of $\frac{8}{32}$ inch, with $\frac{9}{64}$ inch thickness of lead in the outer sheath.

As already noted, a very large amount of insulated cable manufactured is employed in telephonic work. The conductors in most telephone cables are Nos. 19, 20, or 22 B. & S. gauge copper wire. The single wires are first insulated with paper wrapped spirally on the wire, providing in good insulations four thicknesses of paper between the wire and the outside of the insulation. It is so arranged that in doing this work one of each pair of wires receives two wrappings of gray paper, or two wrappings of red paper, or some other contrasting color, so that when the wires are twisted together into pairs each has its distinctive color. It can be readily understood that this means of identification facilitates the work when the cable is put into use. After the wires have been twisted in pairs they are laid up in a coring machine consisting of a series of drums and spindles, revolved in such a manner that at the end of the operation a cable core has been built up which has its alternate layers of wire put together in the same direction and the intermediate layers put on in the opposite direction, the object being to secure a non-inductive core. After this core has been made, it is given a wrapping of heavy manila paper and is then dried very carefully in ovens, in order to secure high insulation and low electrostatic capacity in the finished cables. The next process is that of encasing the core in a lead sheath. Melted lead is put into lead presses, allowed to cool, and subjected to enormous pressure. It assumes a plastic state and is squeezed out around the cable core, where it assumes a solid state and forms a continuous unbroken sheath upon the cable. The lengths of cable are then tested and are ready for shipment on drums to the point of use. The great advantage of paper insulated cable is that its low electrostatic capacity makes it much less expensive than other types. The rubber cable requires three times as much copper conductor as the paper cable, hence as the capacity increases with larger conductors the rubber insulation becomes more expensive than paper, on the basis that rubber cable has about three times the electrostatic capacity of paper cable. The object of making the telephone cables in twisted pairs is to avoid cross-talk induction, and the length of the twist varies from 3 to 6 inches.

Several years ago a type of telephone cable embodying most of the essential requirements mentioned above was developed for the American Bell Telephone system. This "conference specification" was as follows:

Sizes.—Number of pairs, 25, 30, 50, 60, 100, 120.

Conductors.—Copper 19 B. & S. gauge, conductivity 98 per cent of pure copper.

Insulation.—Dry paper.

Conductor arrangement.—Twisted pairs, length of twist not over 3 inches.

Core.—Laid up in successive reversed layers, with a lay of at least one turn in 2 feet.

Seal.—The end of each length sealed with insulating material for at least 2 feet.

Sheath.—The cores to be inclosed in a lead pipe $\frac{1}{8}$ inch thick, having at least 2.9 per cent of tin.

Electrostatic capacity.—Shall not average more than 0.080 microfarads per mil.

Insulation.—One hundred megohms per mil.

Guarantee.—Capacity shall not increase, nor insulation decrease, for five years.

There have been some modifications suggested by experience during the past few years; but the chief one, perhaps, is that which has carried the sizes of cable from 120 pairs up to 200 and even 400 pairs, the economy of the larger cable being considerable. A further modification in telephone cable is due to Dr. M. I. Pupin, who has introduced a method of locating inductance coils in telephone cables in such a manner as to assist the voice currents and prevent the deformation of the waves upon which accurate transmission depends. If the electrical waves have a length of 15 miles, and these balancing inductance coils are placed at such a distance, the current will be assisted by them in its travel and the waves will retain their proper shape, enabling the receiver to give forth the transmitted speech or sound with a minimum loss of volume or quality. Pupin cables have already come into extensive use and, it is understood, have been installed

for service between such points as New York and Philadelphia, enabling the circuits to be placed underground the entire distance.

While reference has been made above to india rubber as a substance that may be said to come in physical competition with paper in the manufacture of insulated wires and cables, it should be added that gutta-percha also is in use to a considerable extent as a gum of the highest insulating quality and as one which is suitable for such work virtually without any preparation beyond that which is necessary in purifying it from foreign materials. Gutta-percha has long been regarded as the standard insulation for submarine cables, but, as until recent years very little submarine cable was manufactured in this country, gutta-percha cable was not regarded as a typical American electrical product. Within the last decade, and particularly within the last five years, these conditions have changed. As late as the time of the Spanish-American War a deep-sea cable had never been manufactured in the United States, prominent as was the association of this country with the very first cable enterprises to span the Atlantic ocean. Through the insistence of Gen. A. W. Greely, Chief Signal Officer, U. S. A., and his faith in the ability of American manufacturers, the first cable was made and laid for war purposes by Col. James Allen of the United States Signal Corps, at Guantanamo, Cuba. Over this cable all the war news was flashed directly to Washington from the seat of operations, and the final victory at Santiago was reported to the White House within an hour of its occurrence.

Another important enterprise and development in this direction occurred a few years later, when in 1902–3 an American company manufactured and laid for the Mexican Government 500 miles of rubber submarine cable in the Gulf of Mexico. This cable is 500 miles long, weighing 1,300 tons, with a deep-sea diameter of 1 inch and a shore-end diameter of twice that size. This cable after manufacture was loaded in four tanks in the cable ship and was laid successfully, since which time it has been in continuous service.

The most extensive and interesting achievement of American manufacturers in this field associated with the United States Signal Corps has been the creation of a new system of over 2,000 miles of American-made cable for the Philippine Islands. This system places Manila in immediate communication with the most distant islands of the archipelago and renders feasible the swift administration of civil and military affairs from the seat of government. A corresponding system of equal magnitude laid with seamless rubber cable of American manufacture is that which has been created by the United States Signal Corps in Alaska, where the network in 1904 included 2,079 miles of cable.

Conduits.—Table 17 shows the value of electric conduits reported in 1900 and 1905.

TABLE 17.—*Electric conduits—value: 1905 and 1900.*

	Total (value).	Interior (value).	Underground (value).
United States, 1905	$2,416,245	[1] $2,153,069	[2] $263,176
1900	1,066,163	(3)	(3)

[1] Includes states as follows: Connecticut, Massachusetts, New Hampshire, New Jersey, New York, and Pennsylvania.
[2] Includes states as follows: California, Connecticut, Indiana, and New York.
[3] Not reported separately.

Unless wires are carried overhead upon poles in the form of single conductors or cables, they are now almost invariably installed in conduits underground, or in interior conduits if used within the buildings. The present report gives a total of $2,416,245 for both classes of electrical conduit, divided into two quite unequal portions, namely, $2,153,069 for the interior class of work and $263,176 for underground conduits. No division was made of this product into the two classes in the census of 1900, when the total reported was $1,066,163. On the other hand, no attempt has been made this time to secure any record as to the mileage of duct feet or of the straight conduit. In the census of 1900 only about half the amount reported was accompanied by statistics from establishments able to report quantities, and the data proved so inconclusive as to render it inadvisable to make a further attempt to determine quantities; although this data would be relatively easy to obtain in connection with interior conduits, as compared with those for underground work, the latter being often of a multiple character. Hence a linear foot of conduit may comprise anywhere from 2 or 4 to 12 or 20, or even more, feet of duct.

In 1905 the production of interior conduit was reported from 10 establishments and of underground from 5, located in 8 states. The statistics in detail by states can not be shown separately without disclosing individual operations. The chief centers of conduit production were, in the order named, Pennsylvania, New Jersey, New York, and Massachusetts, these 4 states producing $2,298,090 of the $2,416,245 for the entire country. The product elsewhere throughout the country was negligible. So far as underground conduit is concerned, it is not to be understood that this embraces all the conduit employed during the year in this class of electrical construction, as material is often used or is made up on the spot which does not come into any regular manufacturing category.

Reference has been made to the statistics of terra cotta and fire clay conduits and electric porcelain supplies, included as part of the industries of that character and reported separately. These are not included in the figures of Table 17 in any manner. As already intimated, however, the total for interior conduits may be taken as representing the full factory value of the product, as "interior" conduit, so called, is made specifically for such use. At the same time it

is not unusual to employ an unlined or uninsulated bare iron pipe of merchant size for some classes of interior work, and this pipe, not being made exclusively for interior electrical purposes, is of course not regarded as coming within that branch of manufacture. The rules of the national electrical code provide that such unlined pipe can be used for wires and cables having a heavy braid on the outer covering. Pipe of this character, as will be readily understood, can also be safely employed for runs of telegraph and telephone or annunciator circuit not exposed to any danger of cross connection or short circuit with other wires carrying heavier currents for light and power.

The interior conduit included in the present statistics consists generally of two classes—insulated metal, such as iron and steel pipe, which has a coat of some enameling and insulating substance, and conduits woven of textile fabrics and impregnated with insulating compounds. In insulated metal conduits the enamel or protective lining is firmly attached to the pipe so as to form an integral part of the surface, and does not break or crack when a length, at a temperature of 212° F., is uniformly bent to an angle of 90° with a curve radius of 15 inches in pipe of 1 inch or less and a radius of fifteen times the diameter of the pipe for larger sizes. This insulated lining is at least $\frac{1}{32}$ inch in thickness, does not soften so as to flow at temperatures below 212°, and is sufficiently resisting to other tests to make it thoroughly satisfactory for protective insulation in the walls of buildings or for placing in elevator shafts and other exposed places. A great deal of ingenuity has also been devoted to the subject of conduits of textile fabrics, and these without protection, or with a metallic sheath, constitute a very large proportion of the interior work now done in the United States. It is now the practice to install the entire conduit system of a new building in advance of wiring, as the building itself progresses, and it is virtually completed before a single wire or cable is drawn in, the ends of the conduit runs being brought out at each floor or room so as to connect with the junction boxes, panel switchboards, and the service wires to the consumption devices, such as lamps, motors, heaters, etc. Some of the wiring is still done in wooden or metal moldings, but this of course is no part of the conduit system, which is now regarded as essentially an integral part of a new building, as the water or gas pipes.

Annunciators and clocks.—Table 18 gives the number and value of annunciators for 1900 and 1905.

TABLE 18.—*Annunciators—number and value: 1905 and 1900.*

STATE.	Number.	Value.
United States, 1905	93,140	$185,870
1900	57,022	[1] 224,885
States, 1905:		
New York	22,019	61,959
Pennsylvania	22,220	40,824
All other states [2]	48,901	83,087

[1] Includes annunciators to the value of $25,320, for which number was not reported.
[2] Includes states as follows: California, Connecticut, Georgia, Illinois, Massachusetts, Michigan, Nebraska, New Jersey, Ohio, Oregon, and Texas.

The value of electric annunciators reported during the census year 1905 was $185,870, as compared with $224,885 five years earlier. As in so many other departments of electrical manufacture, the decrease of value is due rather to simplification and cheapening of the processes of manufacture than to a falling off in the demand. During the year no fewer than 93,140 annunciators were made. A very large number of the small annunciators were made for installation in modern dwellings, few houses of any pretensions being considered complete without an annunciator system connecting the sleeping apartments, servants' quarters, sitting rooms, dining room, etc. The bulk of the apparatus was produced in 5 states, in the order named—New York, Pennsylvania, Michigan, Illinois, and Massachusetts. The value in these 5 states aggregated $173,085, or 93.1 per cent of the total for the United States.

The principal development in this department has been in the substitution of lamp signal annunciators for the earlier needle type. In the new lamp annunciator, instead of needles or drops operated by magnets, the indications are furnished by small telephone switchboard incandescent lamps, which are connected to the various push buttons located at the point of call. In series with these lamps and buttons are lamp relays that are energized when the push button is pressed, and that keep the lamp illuminated until the call has been answered and the lamp has been cut off by means of a short-circuiting button or a number of buttons on the annunciator. Some of these new annunciators have a button to short-circuit the relays in this manner at the bottom of every column of lamps, and the arrangement gives satisfactory results. In connection with this system there is furnished on each annunciator either a single stroke bell or a buzzer, so that when the bell is used and the push button is actuated by the person making the call, one stroke is given on the bell, while when the buzzer is used the indication is given for just the length of time that the push button at the point of call remains in circuit under momentary pressure of the finger. These annunciators have the advantage of taking up less space than the needle type, and, as they are connected into the electric lighting system of the building, they avoid the necessity of a separate equipment of batteries for their operation.

A typical installation of this character is that which was furnished to a hotel in New York city. In each room is installed a special push button having a relay adjustment just behind it, so that when the button is pushed it is locked in by the relay and a lamp on the annunciator board is lighted at the same time that a single-stroke bell is operated. This button is kept locked until the lamp circuit is broken, whereupon it is released, making a slight click, notifying the guest that his call is receiving attention. Another feature of annunciator construction is that the lamps themselves are mounted in brass cylinders which are movable,

the motion being controlled by a spring. These are used to break the circuit, so that by pushing on the glass bull's-eye in front of the lamp the light is extinguished. There are two such annunciators on each floor, one being placed in the service room for service calls and the other in the hall or corridor for the maids' calls.

At another hotel in New York city an annunciator of the lamp type has been installed with 450 indicating lamps. The resetting mechanism to this annunciator is in the form of a button at the foot of each vertical column. This has given very satisfactory service in rapidly clearing out indications that have been noted and in lessening the cost of the individual resetting type, while eliminating the locking button in the guest's room. A further refinement of the system is that which furnishes means for ascertaining the room in which the chambermaid is temporarily engaged, and consists, in brief, of an electric lamp bulb which is carried about by the maid and is inserted by her into a socket as she enters the room, these sockets being provided along the corridor, one near every door. The insertion of the bulb into the socket lights it up and at the same time closes the circuit on a corresponding lamp on the annunciator in the main offices. Thus the location of the maid is indicated at each instant and at each room, both in the office and along the corridor, the process being repeated as the lamp is removed from the socket at one door and inserted at the next.

Table 19 shows the number and value of electric clocks and time mechanisms returned at the censuses of 1900 and 1905.

TABLE 19.—*Electric clocks and time mechanisms—number and value: 1905 and 1900.*

STATE.	Number.	Value.
United States, 1905	33,145	$373,926
1900	9,180	[1] 132,149
States, 1905:		
Illinois	14,195	89,222
Massachusetts	1,799	91,875
All other states [2]	17,151	192,829

[1] Includes clocks and time mechanisms to the value of $110, for which number was not reported.
[2] Includes states as follows: Colorado, Connecticut, Maryland, Missouri, Nebraska, New Jersey, New York, Ohio, and Pennsylvania.

The output of electric clocks and time mechanisms at the time of the census of 1905 was reported as having a value of $373,926, as compared with $132,149 in 1900. There was not only this marked increase in value but there was a corresponding increase in the number of pieces, 9,180 being reported in the earlier year and 33,145 in 1905. The production of this apparatus was carried on chiefly in the states of New York, Massachusetts, Illinois, and Connecticut, in the order named, these states producing 82.2 per cent of the total value for all states. There was also a fairly large output in Pennsylvania, Ohio, and Missouri. The distribution of time by means of electric clocks is a relatively small industry without a widespread demand; but during recent years there has grown up a market for time mechanisms whose object it is to control the use of electric light and power. It may be desired, for example, to have electric lamps within a store burning for a period after the store has closed; or to keep the arc lamps burning outside a store or place of amusement up to a certain hour. For these and kindred purposes the time mechanism is inserted into the circuit and disconnects the lamps, motors, or consumption devices at the predetermined hour. In this manner the services of a lamp trimmer or attendant are dispensed with and the actual time of the use is known. There are several devices of this character. In a recent one, which may be taken as typical, the time switch has for its opening and closing devices a powerful spring-driven mechanism which tends at all times to revolve a disk carrying a crank which operates a loosely jointed connecting rod. This rod serves to open or close the switch with a snap-break movement. The motion of the driving disk is arrested by means of a spring-controlled lever, which is removed from contact with a lug on the disk by means of a hammer blow imparted by springs. The device is provided with two hammers, one for opening and one for closing the switch. The movement of each of these hammers is governed by disks driven at the rate of one revolution during each twenty-four hours. Each disk carries a pin so placed as to raise a steel pin on the corresponding hammer, thus allowing or causing the hammer to strike with a quick snap movement at the set hour for which the disk is adjusted. The two disks are independently adjustable, so that the switch can be set to open and to close at any time desired. This time mechanism is inclosed complete in an iron case ready for installation. It will be understood that there are various other time mechanisms of the same general character for registering the hour, such as watchmen's clocks, and the conveyance of information to a central point as to the increase or lessening of heat and pressure or the height of liquids in receptacles at certain hours.

Rheostats and resistances.—Table 20 shows the number and value of rheostats and resistances for 1905.

TABLE 20.—*Rheostats and resistances—number and value: 1905.*

STATE.	Number.	Value.
United States	75,695	$932,925
California	257	3,956
New York	21,205	230,015
All other states [1]	54,233	698,954

[1] Includes states as follows: Colorado, Connecticut, Illinois, Indiana, Iowa, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, Ohio, Pennsylvania, West Virginia, and Wisconsin.

In the Census report of 1900 all the kindred apparatus in the group of rheostats and resistances, electric

heating and cooking apparatus, electric welding appliances, etc., was massed together, and a total value of $1,186,878 was reported. In the present report it was felt that the increase in the production and use of apparatus for heating, cooking, and welding warranted an effort to separate that class from ordinary rheostats and resistances, and the result is that these data are now presented apart. The returns show a total for the United States of $932,925 as the value of 75,695 pieces of rheostats and resistances which were produced in 39 establishments. By far the largest proportion of this apparatus was produced in the state of Wisconsin, with New York in the second rank; these 2 states accounting in value for more than three-quarters of the total product. This apparatus is a necessary adjunct to the use of heavy current for lighting and power purposes, and large numbers are particularly called for in connection with the starting and regulation of electric motors, electric elevators, etc. Many of the smaller enameled resistances, however, have been introduced for use in connection with the most delicate electrical instruments and are now manufactured for employment as balance coils in telegraph service, and as shunting and ringing resistances in telephone circuits and relay signals. They are also to be found in use as resistances for locomotive electric headlights, for the control of phonographs, for small dental furnaces, etc.

The general principle adopted in the manufacture of all such apparatus is the embedding of fine wire offering high resistance to the passage of the current, in such insulating material as will also serve to take up and dissipate quickly the generated heat due to the interception of the flow of current by the high resistance wire. An idea of the difficulties encountered in such work is afforded by the requirement of the United States Navy Department that starting resistances, for use on shipboard, must be capable when called on of carrying 50 per cent overload of current for one minute and 100 per cent overload for twenty seconds. All resistances and all insulation used on them and their connecting wires must be noncombustible, and all connecting wires must be capable of carrying full-load current continuously without becoming dangerously hot. The method of mounting and insulating the resistances has to be such that the result of a burn-out would be practically the same in negligible effect as would occur with an entirely inclosed resistance. In general, the evil effect of heating must be minimized, both as regards the apparatus protected and in respect to any danger of conflagration from the concentration of so much heat at a given point. An extensive use of rheostats and resistances is made in connection with storage battery equipments for general purposes and more recently in connection with public garages, or plants for automobile charging.

Quite a distinct class of apparatus in this line is that employed on lighting circuits, especially those in theaters, where the increase or decrease in the volume of light, changes in colors, and many other effects are obtained by the use of "dimmer" resistances, which interrupt momentarily and partially the flow of current from the dynamos to the lamps or other illuminating devices. Very few theaters of any pretensions can now be found in the United States without electric lighting, and wherever this is installed "dimmers" will also be found in operation. Some idea of the extent to which they are employed may be formed from the fact that a theater in Chicago has a dimmer bank of 20 plates, with a total capacity sufficient for 810 lamps. A theater in Boston has 66 plates, with a total capacity sufficient for 2,670 lamps; one in New York has no fewer than 124 dimmers; and another, a dimmer board of 50 plates, with a total capacity sufficient for 2,400 lamps. One of the most interesting and capacious theater dimmers was that installed during the census year at Oakland, Cal., said to be the most compact apparatus of its kind, having a capacity sufficient to handle 3,000 lamps, that is, 36 dimmers, each caring for from 75 to 90 lamps, and taking up a space of only 5 feet 9 inches in width by 6 feet in height, and 18 inches in depth. This dimmer is worked independent of any switchboard and is made with as many as 60 to 250 steps, all parts being brought within reach of the hand and all wires and connections being within sight of the operator. Moreover, being mounted upon rollers, it can be moved around to any part of the stage by one man. The usual construction of theater dimmers, as indeed of resistances and rheostats in general, is to build them up in circular plate form, the wire of metallic alloy, which does not rust or fluctuate in its resistance, being embedded in the insulating material within the iron shell of the plate. When used with stationary electric motors, such resistances are placed on the side of the motor or machine or its base, or at some adjacent point, stands and boxes being manufactured for such purposes. In theater dimmers the resistances are usually mounted edgewise in banks, standing up somewhat as dishes on a dresser. The contact fingers move over the face of the plates or disks so as to cut in or out more or less of the resistance. A certain space is allowed between the disks for effective cooling, affording facilities also for insertion or removal of any single plate. These mechanisms are made to work singly or to operate with interlocking gears.

In some forms of apparatus for power purposes the starting and regulating rheostats for the motor are associated in one piece of apparatus. Such apparatus consists typically of a motor starter with a series of field buttons, controlled by a field resistance lever mounted on the same hub post as the starter lever and cooperating therewith. The motor is started and brought up to speed by moving the starter handle, which is also attached to the field regulator. They

thus move as one piece, and during the operation of starting the field resistance is short-circuited by an auxiliary contact mounted on the starter lever and by a curved sector located just below the armature contacts. When the two levers have been moved to the position in which all resistance is cut out of the armature circuits, a magnetic keeper on the starter lever is attracted by the retaining magnet and the lever is thus held in position. At this moment the auxiliary contact has left the curved sector, thus throwing the short-circuit off the field resistance. The field lever is now free to move over the field rheostat buttons on the face of the plate or disk, at the will of the operator, and can be left at any determined point, thus regulating the speed of the motor as desired. If the retaining magnet is deenergized, either by failure of voltage or by the operation of the overload—release devices which protect the apparatus and motor—the starter lever is released and returns to the original starting position, carrying with it the field rheostat lever. This compact and handy type of apparatus is used where it can be placed within reach of the machine attendant, and is usually mounted on the machine tool, whose driving motor it is intended to control. A further development of the disk rheostats has been their connection, on dynamo switchboards and dynamo testing boards, with a plunger or guide brought out to the front of the board so as to operate one or more of the plates and dispense with the former arrangement employing concentric shafts or gear wheels.

Heating apparatus.—Table 21 shows the number and value of electric heating, cooking, and welding apparatus reported in 1905.

TABLE 21.—*Electric heating, cooking, and welding apparatus—number and value: 1905.*

STATE.	Number.	Value.
United States	57,336	$395,827
Michigan	14,630	76,402
New York	5,043	160,960
All other states [1]	37,663	158,465

[1] Includes states as follows: California, Illinois, Maryland, Massachusetts, and Pennsylvania.

The production of apparatus in the United States for electric heating, cooking, and welding bids fair to become one of the largest departments in this field of industry. For while the present output is relatively small, the ramifications of the electric heating art are most numerous, and nearly every week sees a new application that had not previously been attempted or expected. According to the figures of the present census, no fewer than 15 establishments were engaged in the manufacture of these appliances, of which 57,336 were reported as having a total value of $395,827. This apparatus was produced almost entirely in 3 states, New York leading, followed closely by Massachusetts, while Michigan produced about half as much as either of them. Very few pieces of this apparatus were made elsewhere. The increased use of electric stoves, chafing dishes, grills, etc., flatirons and curling irons, soldering, sealing, and branding devices is largely due to the growing appreciation on the part of central station companies of the opportunities thus afforded them for the sale of energy in the daytime when the load upon the generating plant is lighter than at night. An idea of the extent to which such a development is going on is afforded by the fact that the report of the special committee on electric heating of the National Electric Light Association at Denver, in 1905, showed that out of 480 central station companies to which inquiries were addressed no fewer than 112 reported heating and cooking apparatus installed on their circuits. With average prices of electricity applied to apparatus here enumerated, it would appear that a small one-hole electric cooking stove, costing about $4, can be operated for half an hour for 4 cents. An electric flatiron heater costs 2 cents to operate for fifteen minutes. A water heater costs 5 cents an hour; an electric waffle iron, 5 cents for half an hour; a curling iron for the hair, $\frac{6}{10}$ cent for half an hour. This scale of cost does not compare favorably with gas or coal ranges on a basis of steady use; but the great advantages are that the electric current is immediately available, has peculiar advantages in the summer time, and is particularly applicable in places where fuel devices can not be permitted. Of late there has been a marked tendency in large hotels and in clubs toward the introduction of electric grills in the café or restaurant, where the heat given out by an open grill is objectionable, and where a large number of chops, steaks, and other viands are required simultaneously and with expedition. One of the largest of such appliances is capable of cooking over a hundred chops and steaks at the same time, each in its individual compartment. The piece to be cooked is inserted between the walls of a small compartment lined with electric resistances, which, being brought rapidly to a white heat, cook expeditiously and economically while preserving the juices and subjecting every part to the same temperature. The whole apparatus takes far less space than an open grill and is so inclosed that the heat is confined to do its work without radiating freely to the outer atmosphere; and to the casual eye the apparatus has rather the aspect of a refrigerator or a bank of letter boxes than a huge stove.

An effective illustration of the range of such apparatus in variety and utility is afforded by many an American home, and one may be instanced. All the apparatus thus employed is in regular manufacture, so that, provided electric energy is available, it can be installed anywhere. For example, the living room has

an electric radiator for medium warming purposes and an electric cigar lighter placed on the chimney mantel. A spacious veranda around the entire front of the house inclosed by glass is also heated when desired by a luminous electric radiator. In the sewing room is an electric pressing iron. In one of the sleeping rooms are an electric radiator and electric heating pads, which can be slipped between the bedclothes or placed upon the body, and an electric flatiron. The bathroom is fitted up with a small luminous radiator for warmth and a water heater for shaving. The laundry is equipped with electric flatirons, wash boilers, and emergency boiler heater. In a number of rooms the branch lighting circuits are tapped for the insertion of a wall receptacle, to which many of these devices can be temporarily attached, so that their use is not limited to any particular room or part of the house. In the kitchen no coal or gas is used, but everything is cooked by electricity. The cooking and baking outfit, which has been in use for over two years, consists of an electric oven, a cereal cooker, frying pans, vegetable boilers, small disk stoves, gridirons, and meat broilers. This outfit has been operated since its introduction, and for two consecutive Christmas dinners the electric oven has been employed with highly satisfactory results, including the cooking of a 14-pound turkey. The electric gridiron is 9 by 12 inches and is hot enough to fry cakes in two minutes. The cereal cooker is a combination device. In getting breakfast ready it is first used in heating water for the coffee and it is then used as a cereal cooker, and when the cereal is ready the interior dish is removed and eggs are boiled or steamed, using the boiling water then available. Later on potatoes are steamed, either for breakfast or for later meals. The frying pan and vegetable boiler are used frequently, particularly the pan, which is well heated in about a minute and is used principally in preparing bacon and eggs. For the washing of the dishes and utensils, particularly during the summer months, all the water is obtained by means of the emergency boiler heater, there being a receptacle near the sink for this purpose, and almost a momentary use of the current furnishes water adequate to the cleansing out of all the cooking utensils. The question naturally arises as to the cost involved in utilizing apparatus of this character, and it may be noted that twenty-four consecutive monthly bills for electricity during the two years show that the amounts range generally from $3.40 to $9.90, the average being $6.62 per month. This, however, includes the energy consumed for lighting; the bills for illumination previously being about $35 per year. Upon the installation of the heating and cooking apparatus, being largely a day load, the local public service corporation made a special rate of 5 cents per kilowatt hour. The price of apparatus may be arrived at from the statement that for a small family it would cost about $30 and for a large family about $60 for the special equipment, this comparing favorably with large size ranges or combination coal and gas stoves.

Perhaps the best exemplification of electric heating for industrial work is afforded by the equipment of the Government Printing Office in Washington. This office was equipped in 1904 with the largest electric heating system of the kind applied to such work, since when other devices have been added. The use of electric heat in the Office falls broadly into two groups or classes, one of these embracing and including matrix drying tables, wax stamping table, wax-melting kettles, case-warming cabinets, tool heaters, "sweating-on" machines, wax knives, and soldering-iron heaters. The other class, in the binding room, includes embossing and stamping heads, glue-heater equipments, glue-cooking pots, shaping machines for book covers, fitters, tool heaters, pamphlet-covering machines, sealing-wax molders, and other devices. The equipment of these electric heating appliances in the Office supplants steam and gas in all processes, except the stereotype melting pots, which are heated by gas.

The statistics of electric-welding apparatus are included in this section, but are not brought to account separately. Apparatus of this kind is in general use in the United States, and more particularly in connection with the welding of lengths of wire and cable in insulated wire factories and in bicycle and automobile shops. During the past ten years the employment of a number of complex metal parts in the construction of bicycles, and more lately of automobiles, has opened up a new field for the use of electric-welding apparatus. At the time of the Report on Electrical Manufactures in 1900 the rims of the steel supports for the rubber tires were the only parts then treated by this process. Since that time the extension of the art has made the application of electric welding embrace a much wider range, and it is stated that an ordinary automobile may now have as many as from four to twenty different parts that have been united in electric-welding apparatus. The process employed is usually that of bringing the two abutting pieces of the metal to a melting temperature secured by passing a definite and heavy current through them for a short period when pressed together, and thus closing the circuit. This welding is as effective, economical, and durable as can be secured in any other way, with a restriction of the heat required to the exact point of juncture. This method is still employed, or has been until a quite recent date, in the welding of street-car rails in situ, and elaborate sets of apparatus mounted in cars have been devised for such purposes.

Fuses and lightning arresters.—Table 22 presents statistics concerning fuses and lightning arresters reported in 1900 and 1905.

TABLE 22.—*Fuses and lightning arresters—number and value: 1905 and 1900.*

STATE.	Total value.	FUSES.		LIGHTNING ARRESTERS.	
		Number.	Value.	Number.	Value.
United States, 1905	$1,455,203	21,675,765	$868,079	1,324,523	$587,124
1900	595,497	(1)	(1)	(1)	(1)
States, 1905:					
Illinois	207,539	2,098,183	38,230	470,601	169,309
Massachusetts	119,071	1,682,832	119,071	(2)	(2)
New Jersey	236,939	11,960,685	236,939	(2)	(2)
New York	62,550	1,487,500	62,550	(2)	(2)
All other states	829,104	[3] 4,446,565	[3] 411,289	[4] 853,922	[4] 417,815

[1] Not reported separately.
[2] Included in "all other states."
[3] Includes states as follows: California, Connecticut, Georgia, Indiana, Missouri, Ohio, Oregon, Pennsylvania, and Texas.
[4] Includes states as follows: Colorado, Indiana, Iowa, Massachusetts, Missouri, Nebraska, New Jersey, New York, Ohio, Rhode Island, South Carolina, and Wisconsin.

The value of fuses and lightning arresters reported in 1905 was $1,455,203, showing a marked increase over the previous report, when it was returned as $595,497. This increase is due largely, if not wholly, to the general increase in electrical application and also to the recognition of the fact that it is a policy of economy to protect all classes of apparatus against lightning strokes, dangerous sneak currents, or sudden increases of the electrical energy flowing through the circuit. The lightning arrester equipment of a telephone exchange is an important and extensive part of the equipment, but it is probable that in many cases it has been included under the head of telephonic apparatus noted elsewhere, such arresters being made in certain types exclusively for telephonic work. There is, however, a very large field of application left, particularly in electric light, power, and traction, for which the insurance requirements are necessarily severe and exacting. The general type of fuse in the United States to-day is that which is known as "inclosed," the flash or action of the current discharge which opens the circuit taking place within a small chamber, like a cartridge shell. The tube is usually made of fiber, and contains a fusible strip surrounded by a filling material which combines with the material at the moment of "blowing" and thus absorbs or smothers the arc. These fuses are mounted on small stands or in boxes, according to their specific use, and are so arranged as to be readily or even automatically renewed or replaced after the protective action has occurred. In connection with street railway work these fuses are employed in fuse boxes and often in conjunction with circuit breakers, so that the heavier short circuits can be guarded against without damaging result to the apparatus or the persons in the vicinity.

Many fuses are employed of the metal strip type, fusing metal of a special composition being cut into strips, or wire, and held in the circuit between binding posts, so that any undue surplusage of electrical current will cause it to melt, and thus instantaneously open the circuit. These principles and appliances are employed in various ways, but, as noted, the particular form depends upon the use to which it is put and upon the volume of current against which the apparatus must be guarded. The national electrical code on the subject of the use of fuses makes the following provision, which will illustrate in a general way the application of these devices:

An approved cut-out (fuse) should be provided on service directly inside the building. Care should be taken to bring service in at point suitable for safe and convenient location of cut-out. An approved main switch should be provided as near as possible to where service enters, and be within easy reach of floor, so arranged that the entire equipment, including meter, can be disconnected when necessary. This switch should be protected by the main fuses. A separate branch cut-out should be provided for each 660 watts, i. e., the equivalent of about 11 or 12 sixteen candlepower lamps or 1 arc lamp. It is always good practice to have cut-outs assembled in groups, depending somewhat on the nature of the building, and placed in approved cabinets lined with slate, marble, or ½-inch asbestos.

Lightning arresters are of various construction. In one well-known type a magazine of fusible lightning arresters is provided so that they can become operative successively, one fuse providing for each lightning discharge. The arrester consists of two pieces of soft brass wire wrapped at their inner ends to form a discharge gap and inclosed hermetically in a small glass tube. One end of each fuse, or arrester, rests upon a common ground terminal, and the other is connected to the line terminal through a small carbon ball operated by gravity. In another type the arresters are composed of a series of special carbonized rings placed alternately in series with mica rings on an insulated tube, supported by two circular saw-toothed metal caps or brackets secured to the insulated base. The carbonized rings, by their composition and shape, afford an inner as well as an outer discharge circuit for the static charges, but will not permit arcs to form, nor a dynamo current to precede or follow. These arresters have no moving parts. Another form in general use is of the circuit breaker type, in which the air gap is fixed and the circuit is opened by the discharge in an inclosed chamber. This allows the use of a small air gap while providing an easy path to earth for the discharge. A resistance is used in series with the arrester coil to limit the current flow and in shunt to provide a noninductive path around the coil for the discharge. The parts are mounted on the base in such a manner as to avoid breakdown between parts of opposite potential on the surface. One type of lightning arrester manufactured in the United States has no air gap, its essential part being a specially constructed rod of very high ohmic but noninductive resistance, placed between the line and the ground, allowing a constant flow of current to escape through it to the ground, although to a very small degree. The inclosed circuit form of construction, while providing a path that will take care of a little static discharge and a heavier lightning discharge, as compared with an arrester with an air gap, has the advantage of being nonarcing and of having no moving

parts. The fact that the current is in constant flow through the arrester affords an additional assurance that the lightning will follow that path. Another type of lightning arrester which is installed in the power house, on poles carrying feeder lines, or on street railway cars, consists of two round terminals which form an adjustable spark gap, a noninductive resistance, and a magnetic blow-out coil, all inclosed in a porcelain box. The choke coils are interposed between the points where the arrester is connected to the circuit and the generator and motor to be protected. The spark gap terminals are mounted on the under side of the cover of the porcelain box, rendering them readily accessible for cleansing and inspection. For outdoor service the arrester is inclosed in a substantial wooden box. In electric railway work another form of lightning arrester in general use employs choke coils to flatten out the potential wave, while the arrester associated with it affords an easy path to the ground, and prevents the line current from following the discharge.

Included in the total for fuses of Table 22 is a large value, amounting to something over $300,000, reported by several establishments, representing electric fuses or exploders that are employed for setting off dynamite and other explosive charges, submarine mines, etc. The entire amount for 1 state represents fuses of this character. It will, of course, be understood that these fuses are of a somewhat different nature from those which are employed to open the circuit, rendering innocuous an abnormal flow of current or a lightning discharge. Electric fuses of the explosive or detonator character are operated either by means of direct spark from a small magneto-machine or by the incandescence of a thin wire placed in the circuit. This wire usually receives its current from a small battery upon which the circuit can be closed when it is desired to cause the explosion at the point in the circuit where the fuse and the explosive charge have been inserted. These two classes of fuses are known as high tension magneto, or low tension battery. Fulminate of mercury is employed frequently for such electric fuses, and it is a common practice to place a number of them in circuit at the same time, so that in mining and blasting operations several can be exploded simultaneously at different points. A fuller account of such apparatus was given in the chapter on electricity in mining contributed by the present writer to the special report, issued by the Bureau of the Census, on Mines and Quarries, 1902, pages 151 and 152.

Electric measuring instruments.—Table 23 shows the number and value of electric measuring instruments reported at the censuses of 1900 and 1905.

TABLE 23.—ELECTRIC MEASURING INSTRUMENTS—NUMBER AND VALUE: 1905 AND 1900.

STATE.	Total value.	CENTRAL STATION APPARATUS.		METERS FOR CONSUMERS' CIRCUITS.		TESTING AND SCIENTIFIC.	
		Number.	Value.	Number.	Value.	Number.	Value.
United States, 1905	$5,004,763	22,090	$418,998	336,929	$3,585,080	58,067	$1,000,685
1900	1,842,135	(1)	(1)	(1)	(1)	(1)	(1)
States, 1905:							
Illinois	9,050	712	9,050	(2)	(2)	(2)	(2)
Massachusetts	187,469	(2)	(2)	(2)	(2)	16,179	187,469
New York	56,535	1,433	15,854			3,386	40,681
All other states	4,751,709	[3] 19,945	[3] 394,094	[4] 336,929	[4] 3,585,080	[5] 38,502	[5] 772,535

[1] Not reported separately.
[2] Included in "all other states."
[3] Includes states as follows: California, Connecticut, Indiana, Massachusetts, Missouri, New Hampshire, New Jersey, Pennsylvania, and Wisconsin.
[4] Includes states as follows: Illinois, Indiana, Massachusetts, Minnesota, New Hampshire, New Jersey, and Pennsylvania.
[5] Includes states as follows: Connecticut, Georgia, Illinois, Indiana, Missouri, New Hampshire, New Jersey, Ohio, and Pennsylvania.

The production of electric measuring instruments for 1905 shows a large increase over 1900, the gain being from $1,842,135 to $5,004,763, or 171.7 per cent. This gratifying increase may be due in part to the fact that a number of instruments included in the previous report in "all other products" have been here separated more distinctly from the general output of concerns making more than one class of apparatus. The fact remains, however, that the past five years have seen in every department of electricity an adoption of methods for indicating the value and total quantity of electrical energy generated and distributed. No central station or isolated plant can be found without its measuring instruments. This is equally true of electric railway work, while in the field of telegraphy and telephony the employment of such instruments is considered vitally essential to the proper conduct of the business. In the field of electric light and power the earlier practice of selling energy or light at a flat rate is disappearing rapidly; even in small towns and villages it has become the practice to supply the consumer with a meter indicating his consumption of electricity, upon whose readings the bills are based.

At the census of 1900 no attempt was made to distinguish between the three main groups of electrical measuring instruments, namely, those for central stations, those for the consumers' circuits, and those intended for testing and scientific purposes. In the present returns figures have been obtained and are presented in the separate groups, thus giving an idea of the relative importance of these branches of industry. It would appear that 19 concerns were engaged in the production of central station apparatus, 14 in that for metering on consumption circuits, and 28 in

instruments for testing and scientific purposes. Of the central station apparatus, the value reported was $418,998 and the number of instruments was 22,090. By far the larger proportion of these in number and value was made in New Jersey, the states next in importance according to value being Pennsylvania and Massachusetts. To measure at the consumer's end of the line the output indicated by the central station instruments, there were made 336,929 meters, having a total value of $3,585,080, or an average value of about $10.50. The production of this apparatus was distributed widely and was participated in by several states, but owing to the small number of plants in each state the statistics can not be shown separately. Massachusetts, however, was the leading state, being followed by Pennsylvania, New Jersey, Indiana, and Illinois, in the order named, these 5 states accounting for over nine-tenths of the entire output. As a matter of fact, while these meters are being installed throughout the country, the larger cities are the chief centers of their use. New York, for example, with over 50,000 customers for central station supply, requires at least that number of meters. The central station indicating apparatus is practically uniform throughout the country, the leading types being voltmeters, ammeters, wattmeters, and watt-hour meters; but with regard to consumers' meters, although one or two types are predominant, greater variety prevails, depending somewhat upon the system adopted by the local company in charging for its service. A great many of the earlier meters were of the chemical type, but these have disappeared except where the expansion of a liquid by heat is employed to give an indication of the amount of current that has been required at different times and seasons, the charge being adjusted thereto on a sliding scale.

The testing and scientific apparatus is a very large group and includes numerous types and hundreds of varieties, employed not only in practical work, but in laboratories and in physical and scientific research. At one time practically the whole of this apparatus was imported from Europe, but, as will be noted, today there are more factories making it than are engaged in the production of meters of a more strictly commercial nature—an interesting and encouraging evidence of the growing skill of American manufacturers in a peculiarly fine and exacting industry. It is also worthy of note that instruments in all these three general groups are exported in increasing quantities and can be found in use throughout the world. During the year 1905, 58,067 instruments for testing and scientific purposes were made, having a value of $1,000,685. The chief center of their production was New Jersey, and through the commanding genius and inventive ability of one man that state is indeed one of the leaders in all three classes of products shown in Table 23. The other states giving special attention to this particular group of apparatus were Massachusetts, Pennsylvania, Connecticut, and New York.

The class of apparatus of most direct interest to the public is that which determines the amount of its consumption of energy for light and power. The watt-hour meter is one of the best known types of this and embodies a motor device of simple construction and of minute form. It consists essentially of two coarse wire coils placed in series with the circuit whose consumption is to be measured, and a fine wire coil connected in shunt around the circuit. The passage of electricity through the coarse wire coils creates the field of magnetic force which causes the fine wire coil to revolve. This shunt fine wire coil is supported in jeweled bearings, and its rate of rotation is proportional to the current in the circuit. A copper or aluminum disk is mounted on the same shaft as the shunt coil and rotates between the poles or arms of a permanent magnet. The current produced in the disk acts as a drag upon it, the drag being adjusted or calculated to give a speed proportional to the electrical energy supplied to the consumer. The number of revolutions is recorded by a clockwork escapement connected with small dials visible at the top of the meter case, and at any time the customer or the meter inspector can take a reading of the record of kilowatt hours that have been furnished.

A great deal of ingenuity in devising and in producing these small meters has been exercised, and the delicacy of operation involved has given employment to a large number of women, all the parts being of delicate construction, involving deftness of touch in their treatment and assembling. The relation of one industry to another is indicated by the large demand made in these instruments for jewels, such as Eastern sapphires, out of which the bearings are made, while the finest steel piano wire, about 0.03 inch in diameter, is employed for the pivots. A further development of such meters has been in the prepayment class, in which the insertion of a coin, closing the circuit, permits the use of a certain predetermined amount of energy. These meters, developed originally in Europe, are now being used and manufactured in this country also.

Circuit fittings.—Table 24 gives the statistics of production and value of circuit fittings at the census of 1905.

TABLE 24.—*Circuit fittings of all kinds—number and value: 1905.*

STATE.	Number.	Value.
United States	6,820,312	$3,525,446
Massachusetts	99,000	22,411
New York	1,035,220	2,493,242
Ohio	5,846	24,841
Pennsylvania	1,025,875	662,092
All other states[1]	4,654,371	322,860

[1] Includes states as follows: California, Colorado, Connecticut, Delaware, Illinois, Indiana, Michigan, Missouri, Nebraska, New Jersey, Oregon, and Virginia.

A classification which did not appear in the report of 1900 is that of "circuit fittings of all kinds." These were included in the last census under the general

heading of "all other products," but, as will be seen, they now constitute quite an important class, 6,820,312 items being returned, having a value of $3,525,446. The general and increasing utility of electricity for a variety of purposes too numerous to specify has necessitated the invention and manufacture of appliances to which the general name "circuit fittings" has been given, to designate that which is not part of the appliance itself, or part of the generating plant, or part of the distributing circuits and pole lines, but which at the same time is required in order to enable contractors and the public to install such apparatus advantageously. There are endless varieties of brackets, arms, reflectors, keys, connectors, insulating devices, stands, supports, receptacles, rosettes, bell switches, etc.; these multiply daily, each new branch of industry bringing with it novel requirements. There were in the United States 45 establishments engaged in this branch of work, chiefly in the states of New York, Pennsylvania, and Connecticut. By far the largest output was that of New York state, where 12 establishments reported a product of 1,035,220 pieces, having a value of $2,493,242. In Pennsylvania there were 9 establishments reporting 1,025,875 pieces, with a value of $662,092. The figures for Connecticut can not be shown separately.

All other products.—Table 25 shows, for 1900 and 1905, the value of all other electrical machinery, apparatus, and supplies not included in the preceding tables.

TABLE 25.—*All other products—value: 1905 and 1900.*

STATE.	Total value.	Electric switches, signals, and attachments (value).	Magneto ignition apparatus, including spark coils (value).	Electro-therapeutic apparatus (value).	All other products, not specified (value).
United States, 1905	$26,634,963	$1,451,337	$678,077	$1,036,962	$23,468,587
1900	14,783,005	1,129,891	(1)	(1)	13,653,114
States, 1905:					
California	143,275			8,600	134,675
Connecticut	569,003	(2)	(2)	(2)	569,003
Delaware	435,926				435,926
Illinois	1,694,341			502,880	1,191,461
Indiana	723,579		159,610	15,285	548,684
Maine	13,000				13,000
Maryland	32,400			(2)	32,400
Massachusetts	4,817,128	(2)	156,670	34,997	4,625,461
Michigan	123,160		47,710	(2)	75,450
Minnesota	219,087	(2)		(2)	219,087
Missouri	65,690	(2)		(2)	65,690
Nebraska	32,650			(2)	32,650
New Jersey	1,287,464	(2)	(2)	(2)	1,287,464
New York	6,322,666		224,739	306,768	5,791,159
Ohio	4,063,181		56,022	2,200	4,004,959
Pennsylvania	3,932,187	(2)	(2)	80,681	3,851,506
Rhode Island	89,790			(2)	89,790
Tennessee	67,433				67,433
Wisconsin	251,396			(2)	251,396
All other states	1,751,607	[3] 1,451,337	[4] 33,326	[5] 85,551	[6] 181,393

[1] Not reported separately.
[2] Included in "all other states."
[3] Includes states as follows: Connecticut, Kentucky, Massachusetts, Minnesota, Missouri, New Jersey, and Pennsylvania.
[4] Includes states as follows: Connecticut, Georgia, New Jersey, and Pennsylvania.
[5] Includes states as follows: Colorado, Connecticut, Georgia, Iowa, Louisiana, Maryland, Michigan, Minnesota, Missouri, Nebraska, New Jersey, Rhode Island, and Wisconsin.
[6] Includes states as follows: Colorado, Georgia, Iowa, Kansas, Kentucky, Louisiana, New Hampshire, North Carolina, Oregon, Texas, Virginia, and Washington.

One of the largest groups included in this report is that shown in Table 25, for which a total of $26,634,963 was returned for 1905, as compared with $14,783,005 in the preceding Census report. This may seem a large aggregate, deserving of finer and more instructive subdivision, but as a matter of fact it is made up of a large number of individual items, few of which are relatively important. The three groups embraced in the 1905 total which were enumerated separately are "electric switches, signals, and attachments," valued at $1,451,337; "magneto ignition apparatus, including spark coils," valued at $678,077; and "electro-therapeutic apparatus," valued at $1,036,962. The electric switches and signals are in themselves auxiliary portions of what may be said to constitute telegraph systems for conveying intelligence as to the movements of trains, cars, elevators, and other transportation mechanisms. These systems are, as is well understood, elaborate combinations of electrical and mechanical parts.

The rapid development of the hydrocarbon automobile has created an enormous demand for ignition apparatus, the spark from which fires the explosive mixture of the air and gasoline vapor in the carburetter. The general principle is that when the piston is at the top of its stroke the mixture of vapor and air is ignited by the electrical discharge in it, and the violent explosion or expansion drives the piston down with great force, thus imparting motion to the reciprocating and revolving parts of the propulsive mechanism. Various methods of ignition are employed, based upon the electric principle. In what is known as the low-tension system, the car, while running, supplies its own electric sparking current from a small magneto, the moving part of which, in some forms, receives its oscillating action from a cam on the half-time shaft. These oscillations produce an intermittent current in the wire of the magneto-armature, which in turn causes a spark in the cylinder of the carburetter. The high-tension ignition system is that which employs primary or storage batteries, the current from which is sent through an induction coil, thereby inducing or creating a high frequency current. A commutating device, making and breaking contact, produces a high-tension spark within the combustion chamber at the right moment once during every four revolutions of the fly wheel, and the device is so arranged that the time of the spark can be varied by the chauffeur, who thus is able to cause the explosion to take place at an earlier and later point in the explosive stroke in the carburetter, this being known as advancing or retarding the spark. For the provision of a proper spark in the carburetter cylinder, the leading-in wires run to what is known as a sparking plug, which is a small metal device screwed into the top of the combustion chamber and containing a core of mica or porcelain through which the wire is led to a platinum point fixed in close proximity to another platinum point

which is connected directly with the metal of the automobile motor and car, so as to complete the circuit. The ignition spark jumps across the gap between these two platinum points. It is in these classes of apparatus that the magneto ignition devices and spark coils are employed, so that while the hydrocarbon automobile has proved a most serious rival with the electric vehicle it is to-day wholly dependent upon electricity for its ability to operate. No gasoline automobile of the modern type is complete that does not employ in the energization of its mechanism some of the devices included in this category.

The group of electro-therapeutic apparatus, valued at $1,036,962, was produced by no fewer than 66 establishments, chiefly in Illinois and New York. A great deal of this apparatus is still imported from Europe, chiefly from French and German sources, but in general the American medical practitioner has been more ready than those of the Old World to adopt electricity for surgical and curative purposes, and the advance in this country from both the technical and the industrial standpoint has been correspondingly rapid. A large number of medical men may be said to employ electricity solely in their work, and there are numerous clinics where electricity is the sole subject dealt with. Some of the equipments of leading men in this field are of the most elaborate and costly character, arranged in numerous separate compartments each fitted up with its specific or distinctive devices for X-ray work, electric light baths, charged liquid baths, the application of frictional or static electricity, and the treatment of disease where the direct internal or external application of current is deemed necessary. An idea of the importance now attached to this whole class of work may be formed from the fact that one of the sections of the International Electrical Congress held at St. Louis in 1904 was devoted to electro-therapeutics, while the transactions of the section constituted a large part of the report subsequently issued. Incidental to the work of this section was that in other branches of an allied character, such as the purification of water by electrical appliances and current, the study of microbes, treatment by phototherapy, and the effect of fluorescence in human organisms. The development of this whole field has indeed brought with it the requirement for a classification and nomenclature of the principles, phenomena, and apparatus that have become recognized during the past few years.

Laying aside the three classes which have just been referred to above, there remains a total of "all other products, not specified," amounting to $23,468,587. This was manufactured by no fewer than 376 establishments. This large number is in itself an evidence of the miscellaneous character of these factories and their products, and gives an average value of over $60,000 per establishment. It must not be understood that these 376 establishments were engaged exclusively in the production of this miscellaneous class of products, for the majority of them produced other specified electrical products, which have been included in their respective groups in the foregoing tables. The states contributing chiefly were New York, with 93 establishments, whose product was valued at $5,791,159; Massachusetts, 33, with product of $4,625,461; Ohio, 45, with product of $4,004,959; Pennsylvania, 37, with product of $3,851,506; New Jersey, 21, with product of $1,287,464; Illinois, 34, with product of $1,191,461; Connecticut, 15, with product of $569,003; and Indiana, 8, with product of $548,684. It will be observed from the table that these products were fairly well distributed through no fewer than 12 states in which the production exceeded $100,000, and that there were scattered establishments in others with a production aggregating several hundreds of thousands of dollars.

In many cases, especially of the larger companies, the schedules did not show the nature of the "all other products, not specified." Enough were specified, however, to give a fair idea of the character of products which make up the aggregate. They may be roughly grouped and enumerated as follows: Street railway supplies other than car equipment, to the value of $3,115,100, which includes such products as rail bonds and bonding tubes, line material, trolley-wire hangers, brackets and insulators, trolley gears and pinions, trolley wheels, contact alloys, etc. It is possible that one or two of these products are not strictly electrical in their nature, but they seem to be exclusively electrical in destination and use, and could hardly be included in any other industry. Another large class is that of machinery, tools, etc., to the value of $1,948,953. This group includes small electric engines or locomotives, elevators exclusive of motors, machinery for making incandescent lamps, magnetic ore separators, small electric pumps, electric disinfecting machines such as those which generate ozone by sparking, coal mining and cutting machinery, drills, tools, etc. A smaller group of somewhat similar nature consists of dynamo and motor parts and supplies, including armatures and field coils, pole pieces, etc., to a value of $283,224. In the same general group might be placed special controllers for dynamos, motors, and elevators to the value of $296,053, while it would not be an improper stretch of this wide classification also to include in it electrical novelties and toys, amount-

ing to the respectable value of $424,202. The mechanical toys of the present time are largely electrical in their nature, consisting of little dynamos and motors, electric railways, trolley cars, electric launches, portable lamps, and kindred devices. Insulating materials were specified to the value of $760,543, embracing materials of rubber, cloth, paper, compound, rubber substitute, etc.

A large variety of apparatus was reported as electrical household goods to the value of $213,039. This total is made up of such items as bells and push-button appliances, electric speaking tubes, electric door and mail box openers, electric filters, acousticons (for intensifying telephone transmission), and other miscellaneous appliances of the most heterogeneous character, and far too numerous to give even brief mention. A total of $203,659 was returned for electric signs. It is possible that some of the incandescent and miniature lamps are included in this total and to that extent involve duplication of the value reported under the heading of electric lamps. But the bulk of this item is made up of the framework of such signs or of the individual metal letters constituting them. This is a growing industry, but outside of the framework or background for the signs it consists largely in the assembling of other material from which the sign is built up, such as lamps, switches, insulators, wires, and cables. It is the almost universal practice to-day to employ carbon for the brushes making contact with the commutators of dynamos and motors, but other brushes are still in use to some extent, made of strip copper, wire gauze, and kindred material, and for these a value was returned of $84,283. There were also other miscellaneous products named, to the value of $610,902, embracing such items as electrical lining and attachments for wooden cabinets, safes, and vaults, for burglar protection, detailed parts for arc lamps, and jewels for electrical instrument purposes, etc.

Custom work and repairing.—Table 26 shows the amount reported for custom work and repairing at the censuses of 1900 and 1905.

TABLE 26.—*Amount received for custom work and repairing: 1905 and 1900.*

STATE.	Value.
United States, 1905	$2,798,922
1900	2,063,736
States, 1905:	
California	89,558
Colorado	8,350
Connecticut	12,301
Illinois	261,696
Indiana	65,211
Kentucky	8,450
Maryland	11,250
Massachusetts	116,737
Michigan	8,869
Minnesota	37,400
Missouri	100,941
New Jersey	146,619
New York	1,234,460
Ohio	335,251
Pennsylvania	204,634
Rhode Island	41,444
Wisconsin	58,970
All other states [1]	56,781

[1] Includes states as follows: Delaware, Georgia, Iowa, Louisiana, Maine, Nebraska, New Hampshire, North Carolina, Oregon, Tennessee, Texas, Virginia, and Washington.

The amount shown for 1905, $2,798,922, was reported by 331 establishments. These figures call for little comment, as it is a well understood fact that in the large majority of cases every factory has more or less work of this character, where the apparatus or parts of it are returned occasionally for repair or renewal, or where the production of individual pieces of apparatus is undertaken which does not fall within the ordinary line of manufacture. At one time this repair class of work constituted a large and profitable branch of employment for the limited number of electrical factories then in existence, but at the present all the larger electric lighting and power central stations, the electric traction systems, the telegraph systems, and the telephone exchanges have their own repair shops, and forces of men whose work is executed on the spot, not only because it is more economical to do this, but because the apparatus is required promptly in the work.

Table 27 is a detailed summary of the general statistics of the 784 establishments classified as electrical machinery, apparatus, and supplies, by states, for 1905.

TABLE 27.—ELECTRICAL MACHINERY, APPARATUS, AND

		United States.	California.	Colorado.	Connecticut.	Illinois.	Indiana.	Kentucky.
1	Number of establishments	784	24	7	32	104	34	3
	Capital:							
2	Total	$174,066,026	$716,440	$141,800	$4,183,535	$21,644,783	$3,174,505	$203,701
3	Land	$8,157,833	$10,253	$5,500	$138,315	$1,808,263	$118,774	$5,754
4	Buildings	$19,902,359	$23,787	$7,000	$596,067	$2,758,715	$386,453	$25,443
5	Machinery, tools, and implements	$28,787,956	$111,170	$65,300	$568,868	$5,254,379	$858,380	$37,906
6	Cash and sundries	$117,217,878	$571,230	$64,000	$2,880,285	$11,823,426	$1,810,898	$134,598
7	Proprietors and firm members	400	6	1	10	46	13	1
	Salaried officials, clerks, etc.:							
8	Total number	10,619	112	14	225	1,631	384	9
9	Total salaries	$11,090,885	$112,836	$18,450	$278,011	$1,406,868	$382,421	$8,348
	Officers of corporations—							
10	Number	793	17	5	37	109	40	5
11	Salaries	$2,104,554	$27,037	$6,900	$117,182	$280,117	$92,216	$4,200
	General superintendents, managers, clerks, etc.:							
12	Total number	9,826	95	9	188	1,522	344	4
13	Total salaries	$8,986,331	$85,799	$11,550	$160,829	$1,126,751	$290,205	$4,148
	Men—							
14	Number	8,140	87	8	143	1,189	263	3
15	Salaries	$8,058,540	$81,989	$11,300	$141,322	$936,459	$245,404	$3,784
	Women—							
16	Number	1,686	8	1	45	333	81	1
17	Salaries	$927,791	$3,810	$250	$19,507	$190,292	$44,801	$364
	Wage-earners, including pieceworkers, and total wages:							
18	Greatest number employed at any one time during the year	78,360	540	123	1,991	7,380	1,822	111
19	Least number employed at any one time during the year	51,890	310	71	1,408	5,419	1,198	51
20	Average number	60,466	403	89	1,707	6,131	1,416	73
21	Total wages	$31,841,521	$244,123	$54,574	$724,426	$3,203,435	$663,834	$34,518
	Men 16 years and over—							
22	Average number	48,976	364	48	1,197	4,941	1,232	60
23	Wages	$28,316,772	$232,164	$37,074	$593,872	$2,780,370	$615,925	$31,273
	Women 16 years and over—							
24	Average number	10,902	32	41	403	1,186	184	13
25	Wages	$3,410,081	$10,483	$17,500	$112,210	$422,187	$47,909	$3,245
	Children under 16 years—							
26	Average number	588	7		107	4		
27	Wages	$114,668	$1,476		$18,344	$878		
	Average number of wage-earners, including pieceworkers, employed during each month:							
	Men 16 years and over—							
28	January	50,438	368	40	1,204	5,028	1,243	53
29	February	49,337	383	40	1,216	5,223	1,309	54
30	March	49,171	327	40	1,230	5,101	1,261	54
31	April	49,161	332	51	1,203	5,220	1,201	54
32	May	48,740	300	51	1,219	5,286	1,217	59
33	June	48,787	308	72	1,232	5,272	1,228	63
34	July	48,735	357	72	1,231	4,806	1,253	64
35	August	48,065	388	42	1,138	4,777	1,234	65
36	September	48,168	389	44	1,185	4,677	1,214	58
37	October	48,602	401	43	1,164	4,637	1,192	64
38	November	49,074	412	42	1,166	4,563	1,206	66
39	December	49,434	403	39	1,176	4,702	1,226	66
	Women 16 years and over—							
40	January	11,143	33	45	397	1,232	178	4
41	February	11,094	33	45	396	1,181	176	3
42	March	10,984	33	45	414	1,110	185	3
43	April	10,943	31	33	403	1,136	179	21
44	May	10,791	31	32	390	1,164	188	12
45	June	10,689	31	32	376	1,207	189	2
46	July	10,362	31	32	381	1,202	190	1
47	August	10,598	31	32	403	1,260	193	8
48	September	10,637	31	49	410	1,179	191	6
49	October	11,059	33	49	420	1,183	184	34
50	November	11,273	33	49	420	1,162	183	35
51	December	11,251	33	49	426	1,216	172	27
	Children under 16 years—							
52	January	600	7		99	3		
53	February	540	7		108	3		
54	March	559	7		114	4		
55	April	529	7		88	4		
56	May	561	7		86	5		
57	June	549	7		80	6		
58	July	567	6		92	5		
59	August	602	6		110	6		
60	September	629	8		122	3		
61	October	628	8		119	3		
62	November	651	7		135	3		
63	December	641	7		131	3		
	Miscellaneous expenses:							
64	Total	$17,948,708	$74,523	$10,900	$431,226	$1,969,790	$459,061	$14,033
65	Rent of works	$789,349	$18,034	$2,940	$20,560	$181,608	$7,888	
66	Taxes	$545,488	$2,280	$965	$10,142	$99,895	$13,095	$323
67	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$16,347,461	$49,859	$6,795	$400,524	$1,549,153	$435,458	$10,710
68	Contract work	$266,410	$4,350	$200		$139,134	$2,620	$3,000
	Materials used:							
69	Aggregate cost	$66,836,926	$434,241	$65,480	$2,754,122	$7,649,446	$1,066,634	$84,406
	Principal materials—							
70	Total cost	$48,390,836	$385,107	$51,575	$2,499,907	$7,013,141	$890,992	$63,020
71	Purchased in raw state	$1,665,695	$2,245		$45,316	$20	$16,415	
72	Purchased in partially manufactured form	$46,725,141	$382,862	$51,575	$2,454,591	$7,013,121	$874,577	$63,020
73	Fuel	$1,503,111	$3,048	$905	$31,414	$152,922	$49,583	$748
74	Rent of power and heat	$479,091	$7,410	$2,440	$12,060	$61,038	$9,310	$720
75	Mill supplies	$623,394	$1,807	$180	$16,009	$38,228	$8,439	$183
76	All other materials	$15,216,698	$28,037	$10,370	$172,851	$339,246	$106,536	$18,835
77	Freight	$623,796	$8,832	$10	$21,881	$44,871	$1,774	$900
78	Value of products, including amount received for custom work and repairing.	[1] $140,809,369	$1,004,284	$178,759	$4,939,831	$16,700,027	$2,857,174	$169,788

[1] Includes establishments distributed as follows: Delaware, 1; District of Columbia, 2; Georgia, 2; Iowa, 2; Louisiana, 2; Maine, 2; Nebraska, 2; Oregon, 2; South Carolina, 1; Tennessee, 2; Virginia, 2; Washington, 1; West Virginia, 1.

SUPPLIES—DETAILED SUMMARY, BY STATES: 1905.

Maryland.	Massachusetts.	Michigan.	Minnesota.	Missouri.	New Hampshire.	New Jersey.	New York.	Ohio.	Pennsylvania.	Rhode Island.	Texas.	Wisconsin.	All other states.[1]	
6	72	14	15	20	5	42	175	92	80	11	3	23	22	1
$191,315	$12,735,427	$413,732	$389,211	$1,644,031	$162,486	$18,457,821	$30,643,167	$10,408,184	$58,393,011	$3,608,034	$7,800	$6,329,351	$617,692	2
$12,500	$345,900	$1,300	$14,000	$64,350	$6,038	$698,551	$1,699,654	$235,569	$2,674,606	$68,832	....	$225,800	$23,874	3
$43,000	$1,874,094	$6,500	$29,000	$97,523	$3,082	$2,458,166	$4,625,852	$1,291,827	$4,419,640	$621,188	....	$553,273	$81,749	4
$52,669	$2,603,557	$81,847	$125,658	$437,671	$50,015	$3,489,171	$4,702,014	$2,893,023	$5,455,045	$779,461	$3,000	$1,052,856	$165,966	5
$83,146	$7,911,876	$324,085	$220,553	$1,044,487	$103,351	$11,811,933	$19,615,647	$5,987,765	$45,843,720	$2,138,553	$4,800	$4,497,422	$346,103	6
6	37	8	11	5	3	11	95	50	56	8	5	14	19	7
23	871	60	32	183	14	1,012	1,668	1,023	2,746	119	....	396	97	8
$26,248	$962,650	$58,588	$35,960	$193,244	$12,359	$1,002,693	$1,730,441	$1,079,006	$3,089,535	$153,096	....	$450,644	$89,487	9
7	67	14	18	26	4	49	143	100	79	16	....	37	20	10
$15,280	$187,270	$23,515	$27,000	$60,740	$2,900	$214,629	$315,731	$253,222	$297,304	$52,071	....	$97,040	$30,200	11
16	804	46	14	157	10	963	1,525	923	2,667	103	....	359	77	12
$10,968	$775,380	$35,073	$8,960	$132,504	$9,459	$788,064	$1,414,710	$825,784	$2,792,231	$101,025	....	$353,604	$59,287	13
13	633	29	7	120	8	808	1,327	655	2,408	77	....	306	56	14
$9,816	$688,024	$27,278	$5,340	$113,639	$8,845	$698,363	$1,303,569	$690,651	$2,625,575	$87,037	....	$329,183	$50,962	15
3	171	17	7	37	2	155	198	268	259	26	....	53	21	16
$1,152	$87,356	$7,795	$3,620	$18,865	$614	$89,701	$111,141	$135,133	$166,656	$13,988	....	$24,421	$8,325	17
180	10,540	677	202	968	128	7,586	25,246	6,375	10,832	1,631	23	1,463	542	18
139	7,277	418	146	643	54	5,339	14,514	3,985	8,437	1,201	11	982	287	19
161	8,798	529	170	795	83	6,268	16,301	5,114	9,404	1,409	13	1,204	398	20
$65,813	$5,003,190	$176,817	$103,015	$411,804	$32,224	$2,894,139	$9,286,912	$2,268,497	$5,299,668	$557,065	$4,450	$672,812	$140,205	21
139	7,107	372	168	546	44	3,833	14,405	3,747	8,252	1,002	13	1,140	366	22
$62,198	$4,437,918	$148,852	$102,040	$327,999	$22,235	$2,203,102	$8,700,862	$1,874,381	$4,909,121	$442,441	$4,450	$655,891	$134,604	23
14	1,499	143	2	239	39	2,353	1,854	1,352	1,069	398	....	59	22	24
$2,600	$521,185	$25,366	$975	$81,565	$9,989	$676,246	$578,405	$391,776	$375,709	$112,524	....	$15,844	$4,363	25
8	192	14	....	10	....	82	42	15	83	9	....	5	10	26
$1,015	$44,087	$2,599	....	$2,240	....	$14,791	$7,645	$2,340	$14,838	$2,100	....	$1,077	$1,238	27
140	7,928	328	170	484	56	3,894	14,241	3,736	9,104	971	11	1,089	350	28
140	6,607	334	170	501	51	4,111	14,348	3,725	8,650	968	11	1,156	370	29
148	6,635	364	165	522	46	4,107	14,299	3,792	8,469	970	15	1,250	376	30
148	6,727	410	169	546	38	4,006	14,285	3,715	8,446	978	15	1,244	373	31
148	6,773	419	170	573	37	3,930	14,024	3,670	8,236	1,043	15	1,208	362	32
145	6,931	432	172	604	39	3,959	14,080	3,768	8,001	1,015	17	1,097	352	33
149	7,018	414	162	598	42	3,855	14,536	3,768	8,053	919	12	1,080	346	34
122	7,163	404	168	555	45	3,601	14,482	3,725	7,753	933	18	1,093	359	35
126	7,150	389	169	525	43	3,586	14,576	3,832	7,726	1,011	11	1,083	374	36
126	7,286	322	167	542	44	3,511	14,752	3,846	7,950	1,063	8	1,084	400	37
138	7,474	321	169	554	46	3,652	14,731	3,710	8,221	1,080	11	1,126	386	38
138	7,592	327	165	548	41	3,784	14,506	3,677	8,415	1,103	12	1,170	344	39
15	1,694	111	2	242	29	2,264	1,817	1,578	1,059	370	....	50	23	40
15	1,476	113	2	235	24	2,608	1,753	1,535	1,054	368	....	55	22	41
15	1,462	120	2	236	27	2,651	1,751	1,431	1,043	380	....	53	23	42
15	1,462	174	2	241	39	2,596	1,729	1,372	1,048	383	....	58	21	43
15	1,468	179	2	221	41	2,425	1,732	1,344	1,082	388	....	58	19	44
16	1,454	181	2	210	46	2,296	1,745	1,341	1,075	417	....	52	17	45
16	1,462	169	2	217	47	2,287	1,806	977	1,063	403	....	55	21	46
11	1,470	166	2	257	46	2,183	1,775	1,258	1,066	356	....	60	21	47
11	1,470	165	2	249	41	2,120	1,899	1,292	1,060	378	....	60	24	48
11	1,510	116	2	244	48	2,202	2,088	1,348	1,087	406	....	66	28	49
14	1,544	111	2	258	43	2,307	2,075	1,374	1,104	464	....	70	25	50
14	1,516	111	2	258	37	2,297	2,078	1,374	1,087	463	....	71	20	51
8	241	11	....	10	....	77	43	14	68	7	....	5	7	52
8	163	11	....	10	....	84	41	13	68	7	....	10	7	53
8	167	13	....	10	....	85	45	10	70	9	....	10	7	54
8	171	18	....	9	....	82	39	11	67	10	....	8	7	55
8	175	16	....	10	....	90	43	15	82	9	....	8	7	56
8	174	16	....	12	....	76	43	13	90	8	....	3	13	57
8	174	16	....	12	....	80	40	15	93	8	....	3	15	58
8	180	16	....	10	....	83	40	17	92	7	....	3	15	59
8	203	16	....	10	....	81	43	20	90	11	....	3	11	60
8	212	12	....	9	....	80	45	16	92	11	....	2	11	61
8	215	11	....	10	....	84	42	18	95	11	....	2	10	62
8	220	12	....	8	....	82	40	18	89	10	....	3	10	63
$20,679	$1,448,091	$97,031	$30,146	$227,048	$14,496	$1,581,525	$3,263,950	$1,685,514	$5,580,353	$201,343	$1,710	$758,306	$78,983	64
$1,585	$65,160	$10,310	$5,164	$23,401	$2,080	$30,736	$165,311	$126,178	$89,106	$22,344	$1,400	$9,801	$5,743	65
$737	$67,135	$2,201	$1,160	$7,154	$348	$38,491	$149,240	$73,194	$56,194	$10,355	$30	$10,811	$1,738	66
$18,157	$1,289,816	$84,520	$23,822	$196,493	$12,068	$1,510,448	$2,924,023	$1,426,642	$5,431,612	$168,644	$280	$737,435	$71,002	67
$200	$25,980	....	....	....	....	$1,850	$25,376	$59,500	$3,441	....	....	$259	$500	68
$92,600	$7,324,167	$294,374	$186,561	$606,424	$88,388	$6,872,638	$17,846,213	$4,699,140	$11,365,212	$4,017,178	$11,635	$1,020,359	$357,708	69
$57,511	$4,540,404	$269,100	$172,075	$501,219	$79,804	$5,550,986	$11,939,895	$2,767,217	$6,637,141	$3,839,104	$1,420	$804,105	$327,113	70
....	$245,527	....	....	$3,800	....	$533,469	$811,518	....	$7,347	$38		....	....	71
$57,511	$4,294,877	$269,100	$172,075	$497,419	$79,804	$5,017,517	$11,128,377	$2,767,217	$6,629,794	$3,839,066	$1,420	$804,105	$327,113	72
$785	$268,882	$3,838	$3,970	$10,048	$722	$137,029	$424,520	$178,254	$167,150	$13,039	....	$52,847	$3,407	73
$1,617	$67,674	$4,487	$2,230	$13,721	$1,672	$19,096	$205,401	$27,098	$20,368	$8,072	$190	$8,655	$5,832	74
$490	$62,300	$1,170	$546	$4,943	$983	$106,535	$97,982	$57,752	$197,947	$8,267	$25	$18,611	$997	75
$32,147	$2,308,094	$6,052	$5,840	$71,181	$4,038	$992,550	$4,991,757	$1,637,799	$4,233,726	$98,801	$10,000	$130,983	$17,855	76
$50	$76,813	$9,727	$1,900	$5,312	$1,169	$66,442	$186,658	$31,020	$108,880	$49,895	....	$5,158	$2,504	77
$224,859	$15,882,216	$702,102	$423,933	$1,740,583	$149,871	$13,803,476	$35,348,276	$11,019,235	$26,257,569	$5,435,474	$23,055	$3,194,132	$754,725	78

[1] Exclusive of electrical machinery, apparatus, and supplies, valued at $18,742,033, made by establishments engaged primarily in the manufacture of other products. This value was distributed as follows: California, $81,600; Connecticut, $591,094; Illinois, $1,056,263; Indiana, $252,208; Maryland, $400; Massachusetts, $14,900; Michigan, $217,131; Missouri, $205,745; New Hampshire, $28,185; New Jersey, $5,130,814; New York, $5,494,909; Ohio, $1,557,660; Pennsylvania, $2,683,549; Rhode Island, $339,666; Texas, $32,750; Wisconsin, $599,000; "all other states," $456,159.

TABLE 27.—ELECTRICAL MACHINERY, APPARATUS, AND

		United States.	California.	Colorado.	Connecticut.	Illinois.	Indiana.	Kentucky.
	Power:							
79	Number of establishments reporting	710	22	7	31	91	33	1
80	Total horsepower	145,816	278	70	2,748	10,646	4,879	280
	wned—							
	Engines—							
	Steam—							
81	Number	395	2	....	17	20	20	2
82	Horsepower	77,009	70	....	1,806	4,615	2,720	115
	Gas or gasoline—							
83	Number	111	5	1	4	3	12	....
84	Horsepower	2,940	51	3	13	64	112	....
	Water wheels—							
85	Number	52	....	....	3	....	1	....
86	Horsepower	1,155	....	....	180	....	20	....
	Water motors—							
87	Number	7	....	....	1	....	....	....
88	Horsepower	26	....	....	1	....	....	....
	Electric motors—							
89	Number	6,141	....	....	16	1,220	165	50
90	Horsepower	40,440	....	....	243	4,393	1,837	120
91	Other power, horsepower	50	....	....	....	....	....	....
	ented—							
	Electric motors—							
92	Number	2,331	47	13	24	19	30	8
93	Horsepower	21,313	157	67	315	1,195	190	45
94	Other kind, horsepower	2,883	....	....	190	379	....	....
95	Furnished to other establishments, horsepower	4,868	5	....	112	3	....	....

SUPPLIES—DETAILED SUMMARY, BY STATES: 1905—Continued.

Maryland.	Massachusetts.	Michigan.	Minnesota.	Missouri.	New Hampshire.	New Jersey.	New York.	Ohio.	Pennsylvania.	Rhode Island.	Texas.	Wisconsin.	All other states.	
6	69	13	11	18	5	42	150	80	70	10	3	23	20	79
329	15,795	401	140	826	172	8,008	40,811	9,405	43,828	3,317	15	3,372	496	80
1	37	3	1	8	1	40	52	43	126	7	....	16	4	81
60	7,822	225	15	237	4	5,547	21,021	5,596	23,046	1,920	....	1,925	215	82
1	10	3	1	3	1	3	20	15	20	....	....	8	1	83
15	151	20	15	24	3	44	129	490	1,697	....	....	104	5	84
4	6	....	....	....	1	29	1	6	....	....	....	1	....	85
200	145	....	....	....	100	397	18	75	....	....	....	20	....	86
....	1	....	....	5	....	....	....	....	....	....	....	....	....	87
....	10	....	....	15	....	....	....	....	....	....	....	....	....	88
....	1,245	8	....	1	....	296	1,466	652	807	14	....	190	2	89
....	6,454	22	....	2	....	1,461	7,752	2,267	14,590	94	....	1,199	8	90
....	....	....	....	....	....	40	....	....	10	....	....	....	....	91
31	166	25	35	136	2	43	1,419	164	67	8	4	13	77	92
54	1,127	134	110	498	55	311	11,333	791	4,350	177	15	124	265	93
....	80	....	....	....	10	208	558	186	135	1,126	....	....	5	94
15	108	....	....	....	13	....	4,009	80	210	....	....	302	2	95

METAL WORKING MACHINERY

METAL WORKING MACHINERY.

By Fred J. Miller, Expert Special Agent.

The present report on metal working machinery embraces statistics relating to the manufacture of power operated machines for working metals, including also the parts and small tools necessary for the operation of the same. The term "metal working machinery" does not include machines or tools for use in the hand trades, such as plumbers' and tinsmiths' tools and watchmakers' lathes and tools, or rolling mill machinery, cranes, hoists, etc.

The statistics presented at the census of 1905 relate only to products, and no figures are given, as in the 1900 report, for capital, salaried employees, salaries, wage-earners, wages, miscellaneous expenses, and cost of materials used. The manufacture of metal working machinery is so closely connected with the manufacture of foundry and machine shop products that it was found impracticable in 1905 to separate the statistics concerning the manufacture of metal working machinery, except for products. Moreover, the statistics for 1905 are more comprehensive than those for 1900, it being the endeavor in the former to include returns for all establishments in which metal working machinery, including machine tools, is manufactured either as the principal or as a minor product; whereas the statistics for 1900 are confined to establishments in which metal working machinery alone was the principal product.

While the total production of metal working machinery reported at the census of 1905 shows an increase as compared with that for the census of 1900, it must be taken into consideration that the statistics include small machine tools, such as chucks, bits, dies, etc., and all working and interchangeable parts manufactured for metal working machines, which constitute a large proportion of the total product. These tools and parts were doubtless included to a greater extent in 1905 than in 1900, inasmuch as in 1905 there was a specific request made on the schedule calling for the value of the same manufactured during the census year; whereas no separate statistics are available for small tools for metal working machines manufactured in 1900, except under the general heading of "all other metal working machinery," and the large increase this item shows in 1905 in comparison with 1900 is due to some extent to a more complete canvass of the manufacture of this class of products.

In 1900 the statistics chronicled a period of great activity in the iron and steel industries and incidentally in the manufacture of metal working machinery. There was, however, a serious depression in business conditions in 1903, especially in all branches of the iron and steel industry, and although an improvement was noticeable toward the middle of 1904, the effect upon the returns for the manufacture of metal working machinery for that year was not marked.[1]

With these explanations the statistics of metal working machinery production in the United States are presented in 20 tables, which illustrate the industry as reported at the censuses of 1900 and 1905. Table 1 presents the value of products by selected states, with the proportion the value for each state forms of the total for the United States at the censuses of 1900 and 1905, and also the per cent of increase during the five-year period.

Table 1.—*Metal working machinery—value of products, by states, with per cent of total and per cent of increase: 1905 and 1900.*

STATE.	1905		1900		Per cent of increase.
	Value.	Per cent of total value.	Value.	Per cent of total value.	
United States...	$32,408,766	100.0	$24,737,904	100.0	31.0
Connecticut	3,965,742	12.2	3,162,003	12.8	25.4
Illinois	2,015,201	6.2	1,133,589	4.6	77.8
Massachusetts	4,819,687	14.9	2,844,319	11.5	69.4
New Jersey	1,406,005	4.3	1,297,401	5.2	8.4
New York	3,287,064	10.2	1,754,624	7.1	87.3
Ohio	8,197,637	25.3	7,213,157	29.2	13.6
Pennsylvania	3,005,278	9.3	3,324,570	13.4	[1]9.6
Rhode Island	1,915,052	5.9	1,449,891	5.9	32.1
All other states	[2]3,797,100	11.7	[3]2,558,350	10.3	48.4

[1] Decrease.
[2] Includes the value of products of establishments located in Arkansas, California, Colorado, Delaware, Georgia, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Michigan, Minnesota, Missouri, Nebraska, New Hampshire, North Carolina, North Dakota, Oregon, Tennessee, Texas, Vermont, Washington, and Wisconsin.
[3] Includes the value of products of establishments located in California, Delaware, Georgia, Indiana, Iowa, Kentucky, Maine, Maryland, Michigan, Minnesota, Missouri, New Hampshire, North Carolina, Oregon, Vermont, Washington, and Wisconsin.

The greatest production of metal working machinery at the census of 1905 was reported for Ohio, which state was also first in 1900. The value of products for

[1] Statistics of the American Iron Trade for 1904.

Ohio formed over 25 per cent of the total value for the United States, and was greater than the combined value of New York, New Jersey, and Pennsylvania. In Ohio this industry is concentrated to a large degree in Cincinnati and Cleveland, these two cities together reporting 72.5 per cent of the total value of metal working machinery produced in the state in 1905, or 18.3 per cent of the total for the United States. Cincinnati was the leading city in the country in this industry at both censuses, and reported products valued at $3,200,889 in 1905, while Cleveland ranked second in the industry at the last census, with products valued at $2,740,618. Other cities in Ohio which are prominent in the manufacture are Hamilton, Toledo, Canton, Alliance, Springfield, and Warren, in the order named.

The state showing the greatest absolute increase in the manufacture of metal working machinery in 1905 was Massachusetts, the fourth state in rank in 1900, advancing to second place in 1905. The increase, however, was largely for "all other metal working machinery," which was more fully reported at the census of 1905 than at 1900. Worcester, the leading city in this industry in Massachusetts, reported a value of metal working machinery amounting to $1,079,772. There are also a number of large establishments in Worcester county, the products of which, if added to those for the city proper, would make the immediate locality one of the most important centers of this industry in the United States. New Bedford and Greenfield are also prominent in the manufacture of metal working machinery and tools.

Connecticut was the third state in the metal working machinery industry in both 1905 and 1900. The leading city in Connecticut was Hartford, the sixth city in the United States in this industry, and Waterbury, Bridgeport, New Haven, and Torrington also reported a large production. New York state has advanced from fifth place in 1900 to fourth in 1905, reporting an absolute increase in the value of metal working machinery manufactured, second only to that for Massachusetts. New York city, the third city in the United States in this industry, reported 61.3 per cent of the total production for the state, the bulk of this manufacture being in Brooklyn borough. The cities of Rochester and Buffalo also reported a large production of metal working machinery.

One of the noticeable features of the statistics is the fact that Pennsylvania, the second state in the manufacture of metal working machinery in 1900, ranked only fifth in 1905, a slight decrease being shown in the value of products reported for this state. The greater part of this decrease was in Philadelphia, which however, retained fourth rank among the cities of the United States in 1905, with products valued at $1,668,908.

Illinois reported a large increase in the manufacture of metal working machinery, advancing from eighth rank in 1900 to sixth in 1905, Chicago and Rockford reporting the principal production for the state. Rhode Island was seventh among the states in the metal working machinery industry in 1905. Of the total value for the state, 86.2 per cent was reported for Providence, the fifth city of the United States in this industry. New Jersey was the eighth state in the manufacture of metal working machinery in the United States, with Plainfield and Newark as the principal centers. Michigan, the ninth state in rank in 1905, shows a larger per cent of increase than any other state, the gain being due largely to the establishment of a large plant in Detroit in 1902. The production reported for Delaware, the tenth state in rank, was entirely for the city of Wilmington. The states of Wisconsin, Vermont, Indiana, New Hampshire, and Missouri ranked eleventh, twelfth, thirteenth, fourteenth, and fifteenth, respectively, in the production of metal working machinery in the United States as reported at the census of 1905.

Table 2 shows for each fiscal year between 1899 and 1905 the exports of iron and steel manufactures, and machinery of all kinds, including metal working machinery in comparison with the imports of iron and steel manufactures and machinery of all classes.

TABLE 2.—*Exports and imports of iron and steel manufactures and total machinery, and exports of metal working machinery: 1900 to 1904.*[1]

YEAR.	EXPORTS.			IMPORTS.	
	Iron and steel manufactures.	Machinery.		Iron and steel manufactures.	Machinery, all classes.
		Total, all classes.	Metal working machinery.		
1904	$111,948,586	$56,230,291	$3,716,709	$27,028,312	$3,184,968
1903	96,642,467	50,988,606	2,826,111	51,617,312	4,085,825
1902	98,552,562	47,591,534	2,977,290	27,180,247	3,646,572
1901	117,319,320	49,814,489	4,054,313	17,874,789	3,324,765
1900	121,913,548	55,485,495	7,193,390	20,478,728	3,569,096

[1] "Commerce and Navigation of the United States," Bureau of Statistics, Department of Commerce and Labor.

As the foreign trade in iron and steel manufactures and machinery may be taken as an index of the conditions prevailing in the various branches of that industry, Table 2 shows clearly the fact that the manufacture of metal working machinery was depressed during the five-year period. In the table it is seen that the exports of iron and steel manufacture and machinery, including metal working machinery, decreased steadily year by year from 1900 to 1903, inclusive. In the same period the imports advanced largely, the value of iron and steel manufactures imported being over twice as large in 1903 as in 1900. On the other hand, in 1904, when business conditions in this country were improv-

ing in the iron and steel industry, there was a considerable increase in exports of iron and steel manufacture and machinery, including metal working machinery, and a marked decrease in imports, indicating that the production at home had increased and was supplying the domestic trade more completely than for several years previous. Nevertheless, the exports in 1904 show a considerable decrease as compared with the exports for 1900.

Table 3 shows the values reported for the several classes of metal working machinery, with the per cent the value for each forms of the total value; also, the per cent of increase during the five-year period.

TABLE 3.—*Metal working machinery—value of products by class of machines, with per cent each class is of the total and per cent of increase: 1905 and 1900.*

CLASS OF MACHINE.	1905		1900		Per cent of increase.
	Value.	Per cent of total.	Value.	Per cent of total.	
Total	$32,408,766	100.0	$24,737,904	100.0	31.0
Hammers—steam, power, and drop	832,698	2.6	671,287	2.7	24.0
Forging machines, including bolt headers	437,097	1.4	424,774	1.7	2.9
Stamping, flanging, and forming machines	2,003,861	6.2	1,180,960	4.8	69.7
Punching and shearing machines	1,425,510	4.4	1,219,605	4.9	16.9
Bending and straightening rolls	190,578	0.6	202,230	0.8	[1]5.8
Riveting machines	238,829	0.7	139,295	0.6	71.5
Lathes:					
Hand	190,576	0.6	306,081	1.2	[1]37.7
Engine	3,523,470	10.9	4,451,867	18.0	[1]20.9
Turret, including all automatic or semiautomatic lathes for making duplicate pieces	2,210,814	6.8	2,449,121	9.9	[1]9.7
Boring and turning mills or vertical lathes	913,695	2.8	1,123,314	4.6	[1]18.7
Boring and drilling machinery, including all machines using drills or boring bars	2,369,712	7.3	2,779,983	11.2	[1]14.8
Planers, including plate edge planers	1,551,616	4.8	1,808,955	7.3	[1]14.2
Slotters and shapers	845,860	2.6	1,136,350	4.6	[1]25.6
Milling machines, including all machines using a milling cutter	2,476,626	7.6	2,171,966	8.8	14.0
Sawing machines	165,428	0.5	222,563	0.9	[1]25.7
Grinding and polishing machinery, including all machines using abrasive cutters	1,310,903	4.0	880,965	3.6	48.8
Bolt, nut, and pipe threading and tapping machines	899,197	2.8	698,362	2.8	28.8
Pneumatic hand machines	1,732,107	5.3	143,325	0.6	1,108.5
All other metal working machinery	9,090,189	28.1	2,726,901	11.0	233.4

[1] Decrease.

Table 3 shows a number of decreases in several important items, and if it were not for the marked increase in the value of "all other metal working machinery" the total value for 1905 would show only a small increase over 1900. As stated above, the increase in this class of product is due very largely to the greater comprehensiveness of the figures for 1905.

As shown in Table 3, lathes were the principal class of metal working machinery manufactured in both 1905 and 1900. The combined value of this class amounted to 18.3 per cent of the total value in 1905 and 29.1 per cent of the total in 1900. More than one-half of the total value reported for lathes was for engine lathes and over one-third for turret lathes, which includes the automatic and semiautomatic types, while a comparatively small proportion of the value was for hand lathes.

Table 4 shows the number and value of lathes manufactured by selected states for the censuses of 1900 and 1905.

TABLE 4.—*Production of lathes, including automatic, hand, engine, turret, and semiautomatic, by states: 1905 and 1900.*

STATE.	1905		1900	
	Number.	Value.	Number.	Value.
United States	14,486	$5,924,860	19,721	$7,207,069
Connecticut	1,326	700,785	2,108	1,030,314
Illinois	1,061	84,363	1,596	173.071
Massachusetts	4,690	856,946	4,534	1,348,168
New York	523	164,852	2,067	224,504
Ohio	4,639	2,571,883	6,121	2,624,064
Pennsylvania	122	129,112	293	358,759
Rhode Island	610	414,156	702	333,836
Vermont	319	321,765	367	284,411
Wisconsin	148	193,386	238	239,542
All other states	1,048	487,612	1,695	590,400

Over one-half of the total number of lathes manufactured in 1905 were engine lathes, 7,676 in all; 3,912 were hand lathes; and 2,898 turret lathes. The number of engine lathes manufactured in 1900 was 12,089; of hand lathes, 3,945; and of turret lathes, 3,687. It is thus seen that there was a decrease for each class, the greater part of the decrease being for engine lathes.

As seen in Table 4, Ohio was first in the manufacture of lathes, reporting 32 per cent of the total number manufactured at the census of 1905 and 43.4 per cent of the total value. This state also predominated in 1900, when the number reported formed 31 per cent of the total for the United States, and the value, 36.4 per cent of the total. Massachusetts was second in value of lathes manufactured in both 1900 and 1905, and although there was an increase in the number of such machines manufactured in that state, the value reported decreased slightly. The third state in rank in this production was Connecticut, where a considerable increase was shown in value reported of the lathes manufactured.

The class of metal working machinery second in value of products in 1905 was milling machines.

Table 5 shows, by selected states, the number and value of milling machines manufactured in 1900 and 1905.

TABLE 5.—*Production of milling machines, including all machines using a milling cutter, by states: 1905 and 1900.*

STATE.	1905		1900	
	Number.	Value.	Number.	Value.
United States	4,032	$2,476,626	4,119	$2,171,966
Connecticut	557	218,451	431	141,402
Massachusetts	745	376,222	437	317,818
New Jersey	71	115,722	155	167,510
New York	443	116,840	783	297,621
Ohio	856	529,157	1,060	438,725
Pennsylvania	50	110,282	79	110,605
Rhode Island	889	586,263	698	445,342
All other states	421	423,689	476	252,943

Table 5 shows that in spite of a slight decrease in the number of milling machines manufactured in 1905 as compared with 1900, there was an increase in the value of such machines as reported at the two censuses. Rhode Island, Ohio, Massachusetts, and Connecticut, in the order named, were the leading states, and each shows an increase in the value of this class of products.

The class of metal working machinery, which was third in value of products, was boring and drilling machines, including all machines using drills or boring bars.

Table 6 shows by states the number and value of this class of machinery manufactured in 1900 and 1905.

TABLE 6.—*Production of boring and drilling machinery, by states: 1905 and 1900.*

STATE.	1905		1900	
	Number.	Value.	Number.	Value.
United States	23,579	$2,369,712	22,890	$2,779,983
Connecticut	764	153,809	1,093	166,786
Illinois	14,281	334,614	2,936	145,083
Massachusetts	2,837	257,024	7,383	489,504
New Jersey	103	110,504	149	132,193
New York	653	50,112	1,792	83,308
Ohio	3,097	905,680	7,847	1,120,286
Pennsylvania	522	317,304	458	397,455
Rhode Island	130	65,518	128	75,135
All other states	1,192	175,147	1,104	170,233

The term "boring and drilling machinery" includes all metal working machines using drills or boring bars. As shown in Table 6, there was an increase in the number of boring and drilling machines for metal working manufactured in 1905 as compared with 1900, but the value of this class of products was somewhat less at the later census.

Ohio, which was the leading state at both censuses, shows a decrease both in number and value of boring and drilling machines, while Illinois, the second state in rank, shows a considerable increase, advancing from fifth place in 1900. Pennsylvania was third in both 1900 and 1905, while Massachusetts, which was second in 1900, dropped to fourth place in 1905.

Table 7 shows, by states, the number and value of stamping, flanging, and forming machines for plate and sheet metal, manufactured at the censuses of 1900 and 1905.

TABLE 7.—*Production of stamping, flanging, and forming machines for plate and sheet metal, by states: 1905 and 1900.*

STATE.	1905		1900	
	Number.	Value.	Number.	Value.
United States	8,235	$2,003,861	7,895	$1,180,960
Connecticut	711	149,703	645	216,728
Illinois	1,466	284,433	1,205	122,240
New Jersey	145	61,078	196	77,329
New York	4,487	1,057,508	2,362	541,226
Ohio	713	239,685	1,709	67,622
All other states	713	211,454	1,778	155,815

As shown in Table 7, more than one-half of the total value of stamping, flanging, and forming machines manufactured in 1905 was reported for New York, which state was first also in 1900. A considerable increase is shown also for Illinois, which state advanced to second place in 1905, superseding Connecticut, which held that rank in 1900. Ohio, which was prominent in the manufacture of other kinds of metal working machinery, ranked third in the value of stamping, flanging, and forming machines; while Connecticut, second in 1900, is now fourth in rank in this manufacture.

The most marked increase shown for any class of metal working machinery was for pneumatic hand machines, the manufacture of which was of little importance in 1900, but was of such prominence in 1905 as to be entitled to fifth rank in the industry.

Table 8 shows the number and value of this class of machines, as reported at the censuses of 1900 and 1905.

TABLE 8.—*Production of pneumatic hand machines: 1905 and 1900.*

	Census.	Number.	Value.
United States	1905	19,297	$1,732,107
	1900	6,751	143,325

The enormous advance in the manufacture of pneumatic hand machines is indicated in Table 8, the number of such machines manufactured having increased 12,546, or almost twofold, and the value, $1,588,782, or over elevenfold. The principal increase is shown for Michigan and Ohio, the statistics for which states are not presented separately, to avoid the possibility of disclosing individual operations. The increasing use of pneumatic hand machines is described fully in a later section of this report.

The type of metal working machinery next in rank in 1905, according to value of products reported, was planers, including plate edge planers.

Table 9 shows, by states, the number and value of planers manufactured at the last two censuses.

TABLE 9.—*Production of planers, including plate edge planers, by states: 1905 and 1900.*

STATE.	1905		1900	
	Number.	Value.	Number.	Value.
United States	1,100	$1,551,616	1,543	$1,808,955
Connecticut	41	25,253	60	52,782
Massachusetts	257	243,140	368	262,100
Ohio	385	466,836	646	691,362
Pennsylvania	63	252,746	188	248,812
All other states	354	563,641	281	553,899

The decrease shown in Table 9 in the manufacture of this class of metal working machinery is largely for Ohio, which was the principal state in this production in both 1900 and 1905. Pennsylvania and Massachu-

setts were second and third, respectively, in rank, the former state showing a slight increase in 1905 over the value reported in 1900.

The production of punching and shearing machines is shown, by states in Table 10, for 1900 and 1905.

TABLE 10.—*Production of punching and shearing machines, by states: 1905 and 1900.*

STATE.	1905		1900	
	Number.	Value.	Number.	Value.
United States	4,328	$1,425,510	5,269	$1,219,605
Connecticut	127	36,017	1,156	149,400
Illinois	602	142,526	134	68,771
Massachusetts	113	37,075	132	7,008
Michigan	106	9,153	45	18,000
New Jersey	577	69,677	432	82,242
New York	851	294,521	861	154,773
Ohio	330	312,405	395	319,690
Pennsylvania	106	79,267	82	44,499
Wisconsin	667	82,362	288	31,700
All other states	849	362,507	1,744	343,522

Ohio, New York, and Illinois, in the order named, were the three leading states in the value of this production in 1905; in 1900 the first two held the same positions, while Illinois ranked fifth. The first named shows a slight decrease in value of products, while the other two states show large increases.

Table 11 shows by states the number and value of grinding and polishing machines manufactured at the last two censuses.

TABLE 11.—*Production of grinding and polishing machinery, by states: 1905 and 1900.*

STATE.	1905		1900	
	Number.	Value.	Number.	Value.
United States	19,193	$1,310,903	10,014	$880,965
Connecticut	537	126,296	722	77,442
Illinois	109	5,584	1,963	92,464
Massachusetts	1,981	225,258	1,798	124,447
Michigan	983	82,963	301	11,568
New Jersey	232	13,325	50	6,601
New York	4,880	70,732	1,353	54,604
Ohio	1,273	114,840	295	17,126
Pennsylvania	362	267,213	797	143,468
Rhode Island	2,897	343,334	1,868	266,804
Wisconsin	948	32,532	219	48,410
All other states	4,991	28,826	648	38,031

The term "grinding and polishing" includes all metal working machines using an abrasive cutter. This branch of the metal working machinery industry increased largely at the census of 1905 compared with that of 1900, the increase in the number of grinding and polishing machines manufactured being 91.7 per cent and in the value 48.8 per cent. The leading state in the value of these products, both in 1900 and 1905, was Rhode Island, with Pennsylvania second.

Table 12 shows, by states, the number and value of boring and turning mills or vertical lathes for 1900 and 1905.

TABLE 12.—*Production of boring and turning mills or vertical lathes, by states: 1905 and 1900.*

STATE.	1905		1900	
	Number.	Value.	Number.	Value.
United States	611	$913,695	534	$1,123,314
New Jersey	15	24,805	54	177,089
Ohio	99	248,807	140	412,800
Pennsylvania	117	182,600	14	23,985
All other states	380	457,483	326	509,440

There was an increase in the number of boring and turning mills manufactured, but a decrease in value reported in 1905 as compared with 1900. Ohio was the principal state in the value of this production in 1905 as well as in 1900, despite a large decrease. Connecticut, the second state in rank, is not shown separately, as to do so would disclose individual operations. The production for Pennsylvania, the third state in rank in 1905, increased considerably. Delaware, the fourth state in this manufacture, is included with "all other states."

Table 13 shows the number and value of bolt, nut, and pipe threading and tapping machines for 1900 and 1905.

TABLE 13.—*Production of bolt, nut, and pipe threading and tapping machines, by states: 1905 and 1900.*

STATE.	1905		1900	
	Number.	Value.	Number.	Value.
United States	2,687	$899,197	2,088	$698,362
Connecticut	943	209,137	62	19,002
New York	203	128,030	259	128,709
Ohio	855	246,598	975	363,896
Pennsylvania	238	109,343	266	97,034
All other states	448	206,089	526	89,721

An increase is shown in the total number and value of bolt, nut, and pipe threading and tapping machines reported at the census of 1905, as compared with 1900; but in Ohio, the principal state in this manufacture, a decrease is noted. Connecticut, however, shows marked increases, which, with the increases reported for the other states, was sufficient to cause the totals for the United States to show a gain.

The production of slotters and shapers is shown, by states, in Table 14 for 1900 and 1905.

TABLE 14.—*Production of slotters and shapers, by states: 1905 and 1900.*

STATE.	1905		1900	
	Number.	Value.	Number.	Value.
United States	2,012	$845,860	3,076	$1,136,350
Connecticut	167	61,877	457	149,664
Massachusetts	124	33,575	238	79,050
Michigan	108	66,487	159	59,250
New York	64	13,518	334	78,165
Ohio	1,060	331,569	1,354	421,229
Pennsylvania	109	197,826	115	177,732
All other states	380	141,008	419	171,260

The production of slotters and shapers shows a decrease during the period reported, both in the number and the value of machines manufactured. The principal state in the value of these products at both censuses was Ohio, with Pennsylvania second in rank. This branch of the metal working machinery industry is concentrated largely in these two states, the value of their combined products representing 52.7 per cent of the total for these manufactures in 1900 and 62.6 per cent in 1905.

Table 15 shows the number and value of hammers—steam, power, and drop—for 1900 and 1905.

TABLE 15.—*Production of hammers—steam, power, and drop—by states: 1905 and 1900.*

STATE.	1905		1900	
	Number.	Value.	Number.	Value.
United States	1,934	$832,698	857	$671,287
Connecticut	131	114,277	140	115,559
Illinois	208	53,000	24	45,446
Iowa	175	20,700	25	2,300
New Jersey	39	11,730	18	4,200
New York	378	238,642	233	109,968
Ohio	36	63,300	58	53,552
Pennsylvania	205	232,249	225	300,021
All other states	762	98,800	134	40,241

An increase is shown in Table 15, both in the number and value of hammers—steam, power, and drop—reported in 1905, as compared with 1900. The three leading states in this manufacture—New York, Pennsylvania, and Connecticut—together reported 70.3 per cent of the production in 1905 and 78.3 per cent in 1900. In 1905 New York ranked first, having advanced from third place in 1900, and showing an increase in the value of production of 117 per cent. Pennsylvania, first in rank in value of products in 1900, occupies second rank in 1905 with a considerably reduced production, and Connecticut, although holding second place as in 1900, shows a slightly diminished value of products in 1905.

The next class of metal working machines is bolt headers and other machines for forging hot metal with dies and with pressure. This manufacture is shown in Table 16 for the last two censuses.

TABLE 16.—*Production of forging machines, by states: 1905 and 1900.*

STATE.	1905		1900	
	Number.	Value.	Number.	Value.
United States	390	$437,097	821	$424,774
Ohio	195	305,397	230	290,300
All other states	195	131,700	591	134,474

The term "forging machines" includes bolt headers and all other machines for forging hot metal with dies and with pressure. A slight increase is noticeable in the value of this class of machinery manufactured at the census of 1905 as compared with 1900, but the number of machines is considerably less. This branch of the industry is concentrated to a large degree in Ohio, and although these machines are reported as manufactured in a number of other states the statistics can not be shown separately.

Riveting machines are considered as a class of metal working machinery, and the production as reported at the censuses of 1900 and 1905 is shown by states in Table 17.

TABLE 17.—*Production of riveting machines, by states: 1905 and 1900.*

STATE.	1905		1900	
	Number.	Value.	Number.	Value.
United States	645	$238,829	202	$139,295
Connecticut	257	100,657	76	20,728
New York	133	63,172	25	13,200
Ohio	36	9,525	6	300
Pennsylvania	148	42,980	81	102,370
All other states	71	22,495	14	2,697

The manufacture of riveting machines in the United States, though of small extent, increased materially during the five-year period reported. In 1905 Connecticut reported the principal production, superseding Pennsylvania, which was the leading state in 1900.

In Table 18 the number and value of bending and straightening rolls manufactured in 1900 and 1905 is shown by states.

TABLE 18.—*Production of bending and straightening rolls, by states: 1905 and 1900.*

STATE.	1905		1900	
	Number.	Value.	Number.	Value.
United States	174	$190,578	914	$202,230
Ohio	71	81,527	65	73,382
Pennsylvania	16	7,217	16	31,898
All other states	87	101,834	833	96,950

This type of metal working machinery shows a considerable decrease in number of machines reported and only a small decrease in the total value of the same in

1905 as compared with 1900. Ohio, the leading state in this manufacture, shows an increase in the value of production, while a decided decrease is shown for Pennsylvania.

The statistics for sawing machines, a class of metal working machinery which also shows a decrease in the five-year period from 1900 to 1905, are presented by states in Table 19.

TABLE 19.—*Production of sawing machines, by states: 1905 and 1900.*

STATE.	1905		1900	
	Number.	Value.	Number.	Value.
United States	2,806	$165,428	2,846	$222,563
Connecticut	49	1,830	277	11,947
Illinois	701	17,680	1,998	77,310
Ohio	101	23,648	16	2,203
Pennsylvania	209	77,220	193	99,953
All other states	1,746	45,050	362	31,050

The leading state in this manufacture, both in 1900 and 1905, was Pennsylvania; Ohio was second in importance in 1905, superseding Illinois, which was second in 1900.

There are numerous metal working machines not specially classified which are included under the general head of "all other metal working machinery," and this item is seen from Table 3 to form 28.1 per cent of the total for 1905. It may be that certain machines have inadvertently been included under this heading which by a strict ruling might properly belong under some of the itemized classifications, it being very difficult for certain manufacturers to accurately divide their product under the specific headings as required by the schedule. There is also included under this general head small tools, such as chucks, bits, and dies, which make up more than half of the total value reported; precision tools and machines; and duplicate parts, which are made to replace the wear on metal machinery already in use. This latter is a considerable item, inasmuch as most of the machinery in use to-day is standardized; that is, the parts are made largely to be interchangeable, and if a portion of the machine becomes worn or unserviceable it is not necessary to buy an entire new machine or to have a part made to order, as the manufacturer stands ready to furnish duplicate parts without delay.

Table 20 distributes the total value for "all other metal working machinery" among these several specified items for 1905, no separate report having been made for the same in 1900.

TABLE 20.—*Production of "all other metal working machinery," by states: 1905.*

STATE.	Total.	Small tools for metal working machines.	Precision tools and machines.	All other metal working machines and duplicate parts.
United States	$9,090,189	$4,693,186	$995,430	$3,401,573
Connecticut	1,845,650	906,486	34,295	904,869
Illinois	651,609	254,672	21,727	375,210
Massachusetts	2,646,919	1,587,999	687,915	371,005
Michigan	221,703	106,833	....	114,870
Missouri	115,391	59,096	....	56,295
New York	1,036,397	405,091	5,256	626,050
Pennsylvania	392,793	275,024	3,075	114,694
Rhode Island	419,037	129,572	187,276	102,189
All other states	1,760,690	968,413	55,886	736,391

As seen in Table 20, Massachusetts was the principal state in the manufacture of small tools for metal working machines and also in precision tools and machines, with Connecticut second in rank in the former and Rhode Island in the latter manufacture. Connecticut leads in the manufacture of duplicate parts and all other metal working machines, with New York second and Illinois third, while Massachusetts is fourth in rank.

The total value of small tools for metal working machines manufactured in the United States in 1905 was $4,693,186, which was 14.5 per cent of the total for all classes of metal working machines. It was intended that only tools for use in power driven machinery were to be reported under this head, but it is possible that some hand tools have been included. However, as there may be some manufacture of this class of apparatus not reported, it is believed that the value presented is a fairly accurate report of this important branch of metal working machinery manufacture.

The value of duplicate parts and metal working machinery, not specified, as reported at the census of 1905, amounted to 10.5 per cent of the total for all classes of metal working machinery.

The following is a synopsis of the development of the metal working machinery industry from a technical standpoint:

DEVELOPMENT OF THE INDUSTRY.

Foreign use of American tools.—American made metal working machinery is found in almost every portion of the civilized world. Some of the best automobile factories of France, watch factories of Switzerland, small arms factories in Berlin, Germany and Liege, Belgium, and bicycle factories in Coventry, England,

are equipped with American built machinery. It is largely through the use of highly specialized machinery that American manufacturers are able to compete with the products of European shops. Whatever the cause underlying the superiority of American machinery, whether higher grade labor, the great incentive for workingmen to improve the machines they use, or because many mechanics have become manufacturers, or for all these reasons combined, the fact stands out that American tools are used extensively in foreign countries and that their effectiveness is recognized everywhere.

One of the greatest obstacles to the growth of the foreign trade of the United States in metal working machinery has been the difficulty of adjusting American tools to European shop methods, or of educating the European mechanic in the use of American tools. The influence of one upon the other is seen in the modification of American machinery to meet European ideas and the gradual change in European shop methods to meet the requirements of American machines and tools. An evidence of the close touch into which the machine and tool makers of the old and new worlds have been brought is found in the fact that an American technical journal, covering the field of machine tool construction, has 5,000 subscribers in Europe and is the medium for a constant exchange of ideas between the manufacturers and mechanicians of both hemispheres.

Specialization in manufacture.—One of the most striking features of the development of the metal working machinery industry is the specialization in manufacture that has taken place in recent years. This specialization has gone on to such an extent that there is not a single establishment in the United States in which a complete line of metal working machinery is constructed.

In this practice of confining an establishment to the manufacture of one class or a few distinct classes of machines, American builders have pursued a policy quite different from that of foreign builders, who usually are ready to undertake the manufacture of any machinery required by a customer. The tendency in the United States is toward a still greater specialization, and there is some indication of a disposition on the part of British and continental tool builders to adopt the same plan.

The progressiveness of American manufacturers is shown also in their readiness and ability to manufacture special machinery for use in a new machine building industry. This was true of the bicycle industry and is now true of the automobile industry.

High speed steel.—The invention of high speed steel has had a marked effect upon the development of the metal working machinery industry. The first of these steels was invented by Messrs. F. W. Taylor and Maunsel White, at Bethlehem, Pa., some time previous to the Paris Exposition of 1900. At that exposition they exhibited tools made of this steel, in use in a heavy and powerful lathe, taking heavy cuts at unheard of speeds—80, 90, or 100 feet per minute, instead of the 18 to 22 feet per minute that previously had been the maximum for heavy cuts in hard material. Such work attracted a great deal of attention, not only among builders of machinery, a considerable part of whose work consists in taking heavy cuts from imperfectly shaped castings or forgings, but also among steelmakers, a large number of whom, recognizing the importance of such steel, have undertaken to manufacture it.

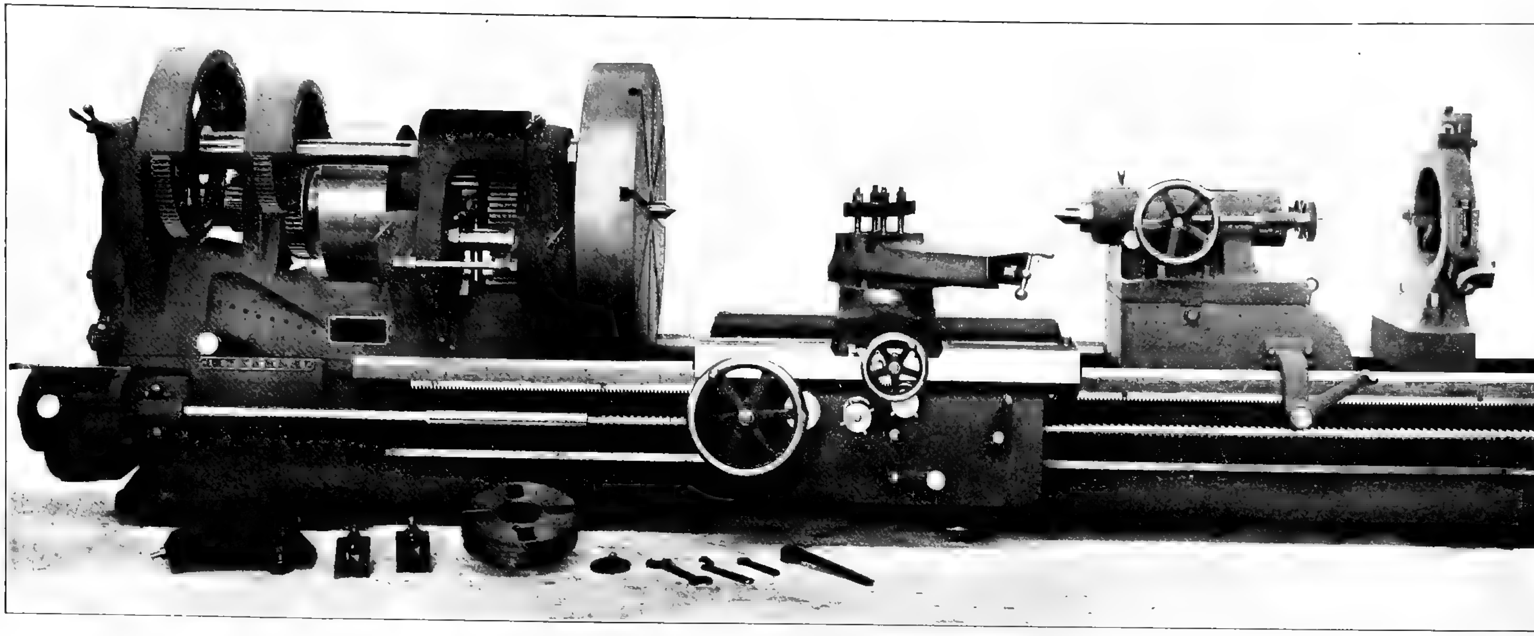
Although it is true that high speed steel is not stronger and will not take a heavier cut than the carbon steel previously used, if indeed so heavy, the fact that it will take a cut nearly as heavy at a very much higher speed has led to important modifications of certain metal working machines, especially lathes for heavy work.

One modification has been the redesigning of the driving mechanism of the lathe to make it capable of enduring for a reasonable time the stress of the greatly increased speeds. The belts and gears by means of which the power was commonly conveyed were so changed as to give the same torque, or driving force, with greatly increased speeds.

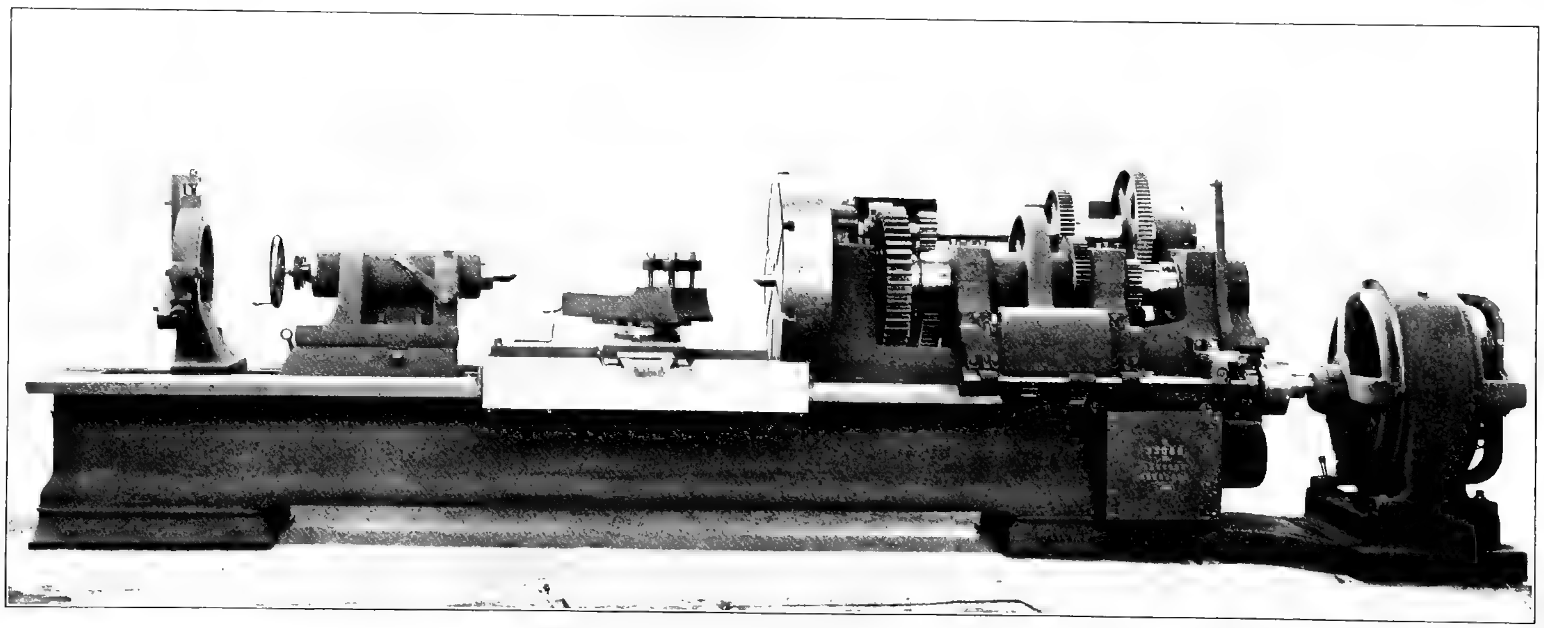
Another important modification has resulted from the fact that systematic tests made to show just how fast a heavy cut could be taken have led to a change of ideas as to what constitutes a heavy cut, and to a demand on the part of machine tool users for machines that will not only endure the higher speeds called for by the new steels but will also carry heavier cuts than were formerly thought to be practicable.

The use of high speed steel has resulted in a considerable reduction of the cost of certain kinds of work in machine construction, especially the removal of surplus metal from forgings and castings of iron and steel. This has led to some misunderstanding as to the total net effect of the use of high speed steel, the fact having often been overlooked that in the construction of many kinds of machinery, the chief item of expense is not the cost of taking such heavy cuts as may be required but the cost of the finishing processes which involve the taking of light cuts, careful gauging, grinding, hand scraping, and other operations that must be performed with care by skilled men. The cost of the finishing processes has been reduced but little by the use of high speed steels, and as in many cases they constitute the principal item of cost, high speed steel has affected the cost of producing the finer grades of machines much less than might have been expected.

Speed adjustment.—The use of high speed steels has led also to a much closer scrutiny of the speeds and feeds, or in other words, the rate of cutting and the thickness of the chip taken in cutting metals, and thus has



LATHE ARRANGED FOR DRIVING BY A CONSTANT SPEED BELT.



REAR VIEW OF LATHE DRIVEN BY ELECTRIC MOTOR.

stimulated greatly the development of speed changing devices. Until a few years ago the stepped or so-called cone pulley, with one change by gearing, was practically the only device employed for altering the speed of a machine tool to adapt the speed to the requirements of the work in hand. Within the past five years, however, there has come the development and application of many new devices for this purpose, by means of which the operator, by merely shifting a lever, alters the speed without having to stop the machine to shift the driving belt from one to another position upon the pulleys, and without changing the speed of the driving belt itself. The belt is thus enabled, by its constant speed, to deliver energy to the machine at a uniform rate; a thing which it can not do when running upon cone pulleys, and which it is important that it should be able to do. An illustration of a lathe arranged for driving by a constant speed belt is shown on plate facing page 14.

Some of the geared heads developed by the improvement of speed changing devices are capable of imparting to the work not only a great total range of speeds, but the changes from a given rate to the next higher or the next lower are by much finer gradations; as a result there is a smaller loss of efficiency due to the fact that the available rate of speed nearest to that which would be exactly right for the work in hand is too high or too low. The ideal toward which designers are striving is an arrangement that, for any given piece of work within the capacity of the lathe or other tool, will give the exact speed for that work.

Electricity also has played an important part in the development of speed changing devices. Many machine tools are now driven by direct connected motors. In some instances the motors are incorporated as an integral part of the design, in others they appear rather as an attachment to the machine, which can with little alteration be driven either by a belt from shafting in the ordinary way or by a motor. The motors themselves are often arranged to run at varying speeds, though seldom with sufficient variation to cover the whole range required, the remaining speeds being obtained by the use of gears manipulated by shifting levers. By means of resistance boxes or of motors constructed so as to run at different speeds without the use of such boxes, together with gear devices, great ranges of speed, changing by small gradations, have been attained.

An illustration of a lathe driven by an electric motor is shown on plate facing page 14.

The front and rear views of a lathe having these modern driving arrangements are shown in the preceding illustrations; the lathe in each case being essentially the same but arranged for belt driving in one case and for motor drive in the other. Of the four uprights and bearings on the headstock, only the two outside or end ones support the spindle, the inner ones supporting only a sleeve to which the power is applied for driving, and which is bored through somewhat larger than the spindle so that there is no bearing of the one upon the other. The speed of the first motion shaft is constant and from it the varying speeds required for the work are obtained by the various gears shown, different combinations of which are obtained by means of clutches.

Portable tools.—The tendency to do things on an increasingly larger scale in all branches of industry has had a marked effect upon the machine tool industry, in that it has caused machine tools to be built larger, and has also given rise to the invention and adoption of smaller or portable tools.

Machine tools of large size are constructed to perform such work as is required at the time they are made. Since the cost of such tools is high, and their maintenance constitutes a large item of expense, the work they are called upon to do grows constantly larger. Nevertheless it has been found that certain classes of machine tools can not be built larger to advantage, since many castings which were formerly handled within the machines are now of such great size and weight as to make this method of machining them practically impossible.

To meet this condition a class of machine tools has been evolved which is designated as "portable;" these tools are portable in the sense that traveling cranes may pick them up and carry them where wanted. Such tools, instead of being constructed of such size and power as to enable them to take large castings within themselves, are designed only to hold, direct, and drive the cutting tools needed for the various operations to be performed, the pieces operated upon being held stationary upon the floor plates.

Attached or incorporated electric motors are employed usually for driving these portable tools. This enables them to be conveniently driven in any position in which it may be necessary to place them. It is now common to see a number of such portable tools working simultaneously upon one casting, so that boring, drilling, slotting, milling, key seating and other operations may all be done at one time, each independent of the others.

One of the latest and most interesting features of such work is the practice of setting in position both the work and the tools by means of a transit, much like that employed by civil engineers in surveying, but made with considerably greater refinement. This enables the attainment of the degree of accuracy required where allowable limits of error are usually stated in thousandths of an inch. These refinements have in turn raised the standard of accuracy so that in large electric generators and similar heavy work a degree of accuracy is now easily attained that would have been impracticable a few years ago.

Automatics.—A class of machines originally designed for making screws, but more recently employed also in making numerous small parts of machines and

other articles, and known to the trade as "automatics," has been developed considerably during the period covered by this report.

Only a few years ago automatic machines were made to handle stock only up to about 1 inch in diameter, and an "automatic" that could handle inch stock was looked upon as a large machine of its class. At first they were used almost exclusively for making the screws, hence the name "automatic screw machines." They are now made to handle steel bars up to 6 inches in diameter and are used for an almost endless variety of small parts. A more appropriate name for such machines, therefore, would be "automatic turret lathes," as their present function is not merely to make screws, but also to do lathe work.

An important addition to the automatic screw machines is the "magazine" attached to them, by means of which castings or small forgings are fed successively to the machines. At the Paris Exposition of 1900 an American tool builder exhibited a screw machine thus equipped which did all the machining operations upon the handwheel of a sewing machine, and required no attention whatever except to keep the magazine supplied with castings and the various cutting tools sharp and properly adjusted.

The variety of automatics known as the "multiple-spindle automatic" in particular has been developed greatly. In this machine there may be as many as five spindles, each holding and driving a separate bar of stock, to which the cutting tools are presented simultaneously for action. This means that a screw or other article requiring as many as five distinct operations to complete it may be made on this machine in the time required for performing the longest operation, because the tools used for performing the four shorter operations complete these before the operation requiring the longest time is completed. In some cases the apparently impossible task of reducing this time can be accomplished, as, for instance, where the time required for the longest operation is considerably greater than that required for any other, and the total number of operations to be performed is at least one less than the number of spindles in the machine. In such a case the principal operation is divided between two spindles, each performing one-half, so that the total time required for completing the piece is reduced to that of the next shorter operation, and thus the capacity of the machine is increased greatly.

A multiple-spindle machine is shown on the plate facing page 16, the four work-holding spindles being seen at the left and the tool-holding spindles in line with them at the right. In this machine the work-holding spindles may either rotate or remain stationary during a given operation and the tool-holding spindles may do the same. This fact is taken advantage of in arranging the various cutting speeds required. A speed may be that due to the rotation of the work-holding spindle alone, to that of the tool-holding spindle alone, or it may be the sum of or the difference between the two.

In threading work the operation of this machine differs from that of all others in that the work is held stationary during this process, and that all the chips are carried away by the oil being forced through the die-holding spindle, which is hollow, and through the die. When the thread is completed, no change takes place in the rotation of the die-holding spindle, but the work-holding spindle commences to rotate at higher speed in the same direction, and thus runs the die off without reversing the rotary motion.

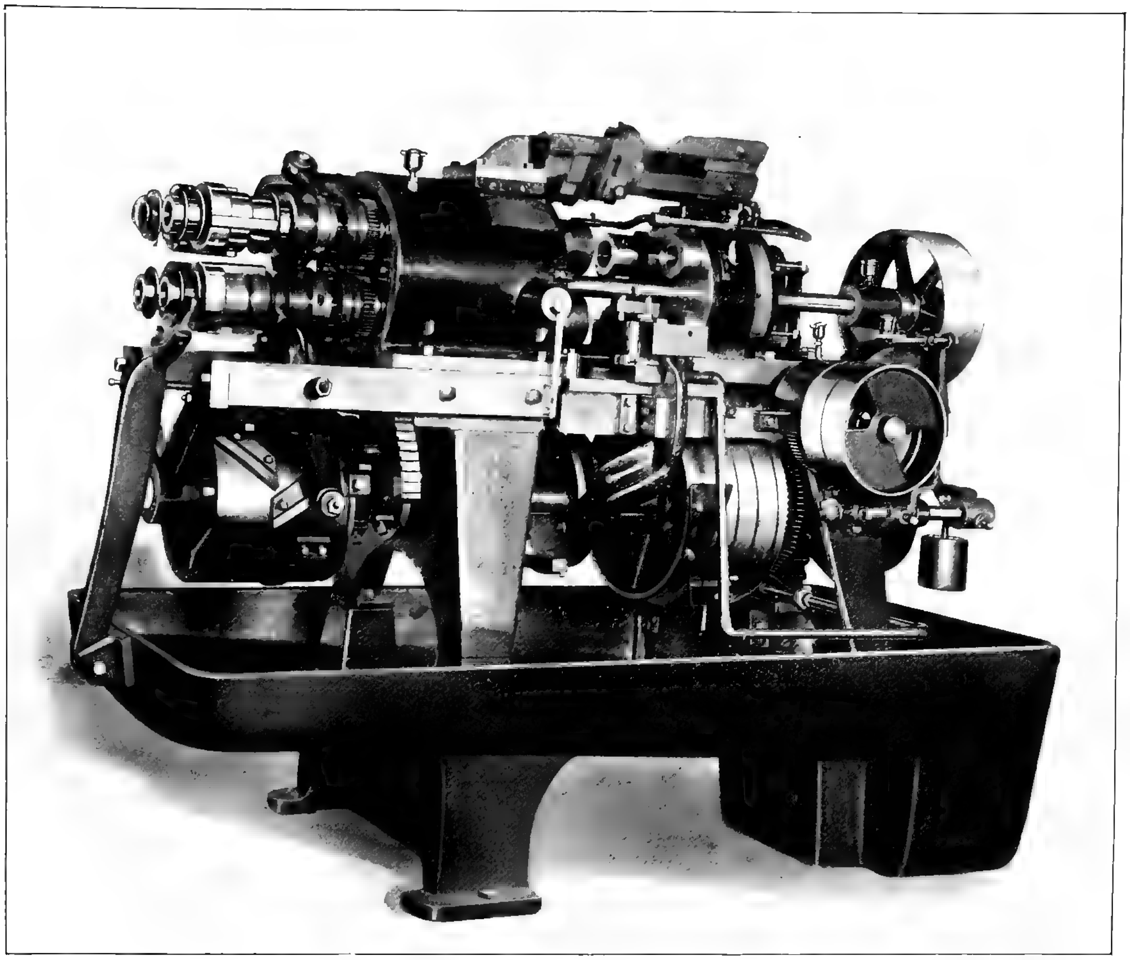
In another machine of the automatic class, which is still in the process of development, compressed air is used for moving the various parts of the machine in order to present the tools consecutively to the work and for the motions necessary for the cutting operations. The extreme lightness of air as compared with the mechanisms ordinarily employed for this purpose enables the motions usually designated as "idle motions" (to distinguish them from the motions used in actual cutting) to be made much more quickly than is otherwise possible, and thus the time consumed in the withdrawal of one tool and the presentation of another is reduced greatly.

Such improvements as these do not, however, materially reduce the labor cost of producing the work, because they do not affect the relatively small proportion of the work done by the operator. They reduce the cost only by giving a greater product with a given investment in machinery and tool equipment and within a given area of shop floor occupied. This reduction forms, however, in many cases a considerable proportion of the original total cost.

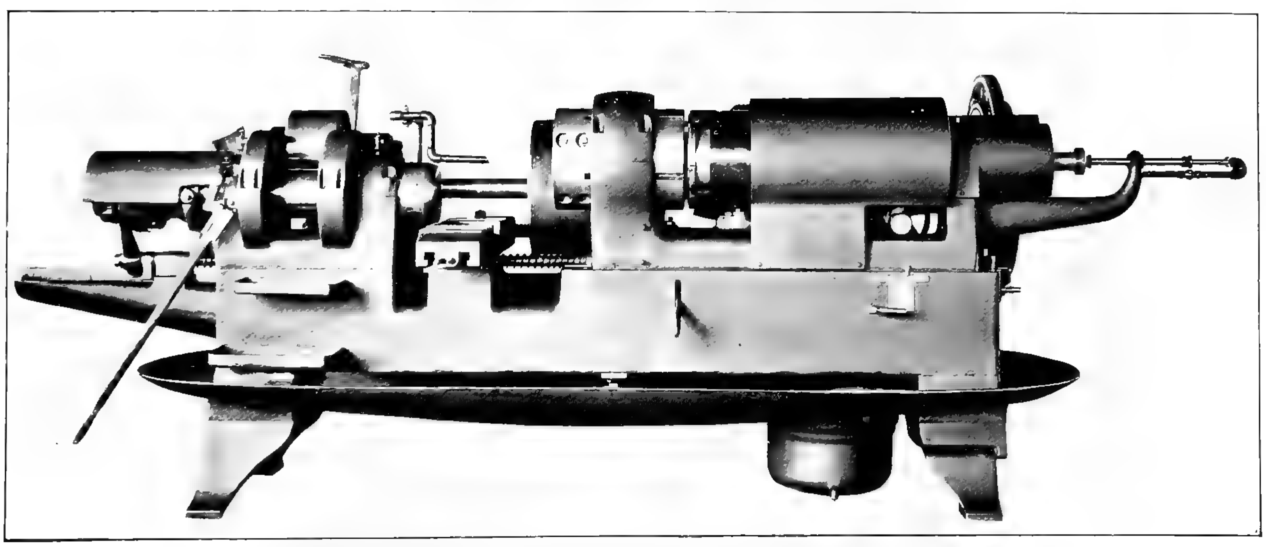
Compressed air seems likely to be used more extensively as machine tools are developed. The facility and rapidity with which it can be conveyed and its small mass makes it well adapted for use in metal working machinery. In fact, its extreme rapidity needs checking in some instances where uniformity of motion is required under varying resistance, and this check is applied by the use of a body of water or oil, which is forced by the air pressure through a restricted but usually adjustable opening and in turn acts upon the mechanism to be moved. The liquid, by resisting sudden changes in its rate of flow, regulates the speed of the motion.

The increasing use of automatic machine tools has led to the regular manufacture of automatic screw machines large enough to take bars of steel through their spindles up to 6 inches diameter and to make parts of machines from such bars. An illustration of such a machine is shown on the plate facing page 16.

The bars of stock, which may be the diameter named above and 10 feet in length and weighing about 1,000 pounds, pass through the spindle seen at the left, which is driven by incased gears that in turn are



MULTIPLE-SPINDLE AUTOMATIC SCREW MACHINE



AUTOMATIC SCREW MACHINE FOR WORKING BARS 6 INCHES IN DIAMETER.

driven by pinions upon the shaft at the rear, on which the pulleys are to be seen. The turret in this type of machine has a horizontal axis, which is sufficiently offset from that of the spindle to bring the various cutting tools successively into line with the spindle for action. On the cross slide tools having a width up to 7 inches can be used for forming work, and the machine handles the 6-inch bars of steel entirely automatically with as much certainty and as little trouble as the smaller and more common sizes handle half-inch bars. The pipe connection at the extreme right is for forcing oil through the cutting tools, and the arrangement is such that only the tool which is in line with the spindle—i. e., in position for working—gets a supply of oil. The various levers seen are only for manipulating the machine at starting or in "setting up," its action being entirely automatic after it is started.

An automatic screw machine in which there is a partial application of compressed air for effecting the required movements is shown on the plate facing page 18.

The machine shown is equipped with a horizontal disk, which is placed above the turret and performs the function of a magazine. The machine is shown as arranged for drilling, chamfering, and tapping brass nuts for a 1-inch standard pipe thread, and all that is necessary is to place the blanks in the shallow recesses upon the surface of the disk. The machine presents them successively in position to be gripped by a vertically moving mechanism, which, taking one blank at a time, carries it down to a position in front of the chuck, from which it is placed within the chuck jaws. The chuck is then closed by air pressure, the various operations completed, and the finished nut ejected. The illustration gives a rear view of the machine, which shows the working parts better than a front view.

Some little adaptation of the turret mechanism usually has to be made for different pieces, and in the case of such a piece as a handwheel for a sewing machine the magazine is attached to the head stock instead of the turret, and the wheels move by gravity one after the other into position to be gripped by the device which carries them in front of the chuck. By some such means almost any casting or forging required in numbers sufficient to justify the outlay for tools and appliances can be finished without other manual labor than that required to place it in the magazine.

An "automatic" of a different type is shown on the plate facing page 18. This machine is intended for bars of stock up to seven-eighths of an inch in diameter and will feed this stock forward toward the tools any required distance up to 4 inches at a single movement. The machine is remarkable for its compactness, and its motions are made with great rapidity.

In general design it is a radical departure from the earlier machine shown in the special report made at the census of 1880. The turret has a horizontal instead of a vertical axis, and this axis lies at right angles to the axis of the spindle, thus bringing the turret nearer the operator for convenience in "setting up," and affording plenty of clear space for the tools.

The various motions are derived from cams which are placed upon two shafts running lengthwise to the bed. These shafts run comparatively fast, so that quick motions of the various tools are secured with very moderate angles of action upon the cams. The same illustration would answer for a number of similar machines of different sizes. Hardened steel parts are used freely to enable the machine to withstand the shocks incident to great rapidity of motion, and its freedom from noise is remarkable.

New grinding process.—The process of grinding, which was formerly applied only to the work of finishing true and to size such parts of machines and tools as were made of steel so hardened as to make cutting tools unavailable, has of recent years been developed and applied much more widely than before. It is now used for finishing to size many cylindrical parts of machines formerly finished by the much less certain and precise method of turning in a lathe.

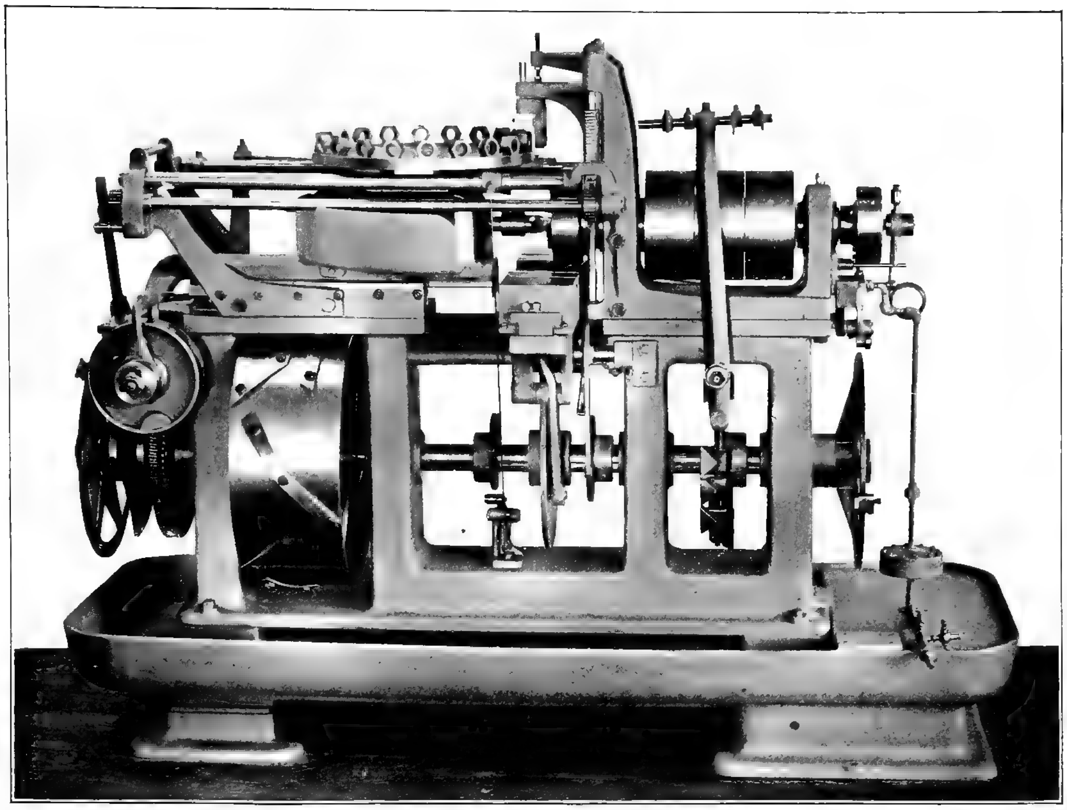
Marvelous results in grinding have been obtained by applying great power to driving a relatively large and heavy abrasive wheel which at every turn is made to sweep over the work the full width of the wheel. For instance, in refinishing locomotive piston rods that have become badly worn or scored, a special grinding machine of this kind has been invented which does the work more quickly and with much greater precision than is possible by the older methods. In finishing automobile crank shafts, work which is tedious by ordinary methods, this process of grinding has proven remarkably efficient.

Interchangeable tools.—As a result of the specialization in machine tool manufacturing, many American tools are now made wholly or in part upon the interchangeable plan. The extent to which this plan is used in a given shop depends mainly upon the number of identical machines to be built. Most machine tool establishments have long made certain parts of their machines upon the interchangeable system. Screws, bolts, change gears, and other things, component parts of engine lathes and used in numbers much larger than the number of lathes built, have usually been made in large quantities "for stock." Such parts can be made upon the interchangeable plan with sufficient accuracy, by means of special tools and gauges which cost little, if any, more than such tools as would be required to make similar parts without regard to interchangeability. For other parts of the lathe,

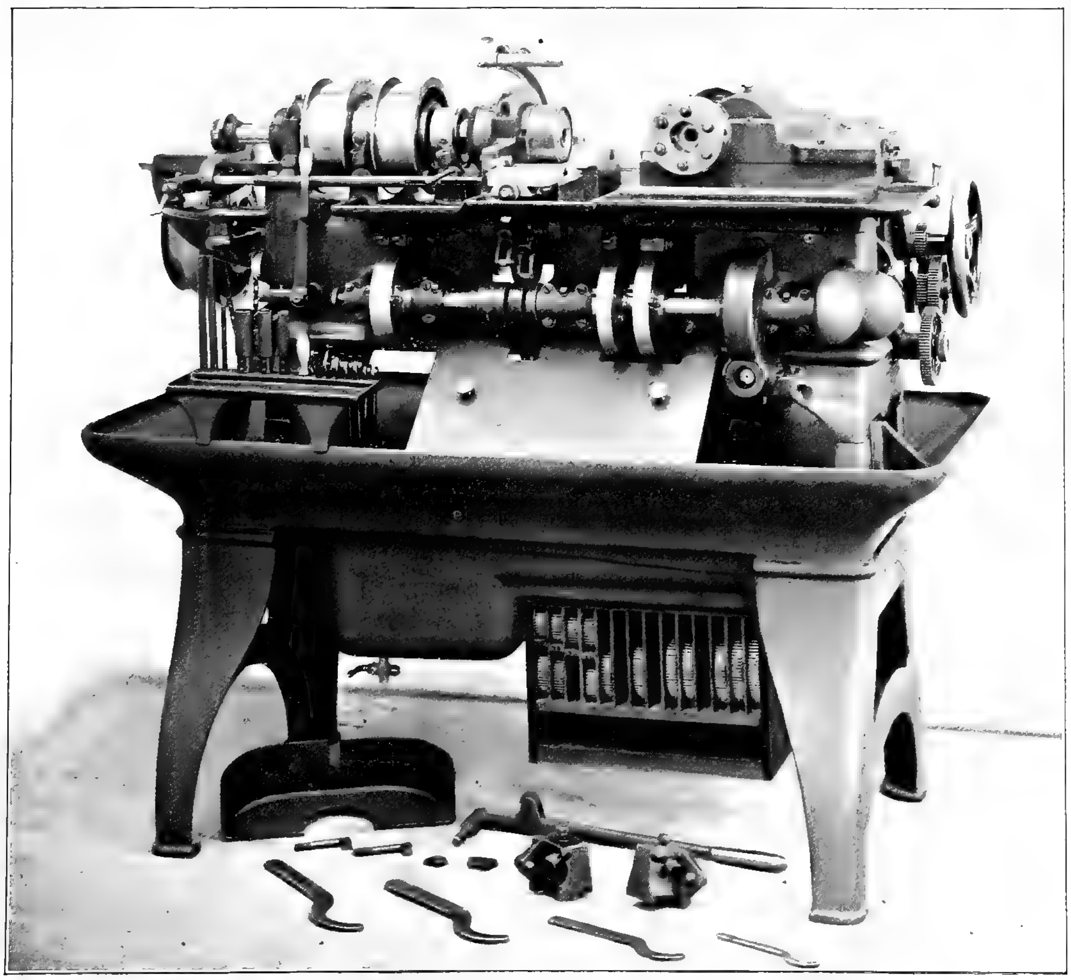
however, the tool equipment required for interchangeable manufacture is more elaborate. Such tools have been made and used only as the number of identical lathes to be manufactured in a given shop has increased to a point justifying the expense.

This fact has led to a great difference in practice between different shops; those building many lathes having carried the principle of interchangeable manufacture very far, while others have applied it to only a limited extent. Naturally also the size of the lathes built in a shop has considerable influence, because for large lathes, built in small numbers and for which the tools and fixtures are much more costly, a point is soon reached at which the proportionate cost for tools which must be charged to each lathe becomes prohibitive.

The development of the industry which has been going on has, however, led to an increasing application of the principle of interchangeable manufacture to the production of metal working machinery, and this is one of the most prominent, important, and interesting features of the business as now carried on. Even some of the larger machines which, a few years ago were built one at a time and only upon orders, are now manufactured in considerable numbers by the aid of special tools and fixtures and with many if not all of their parts interchangeable.



AUTOMATIC SCREW MACHINE WITH MAGAZINE ATTACHMENT



AUTOMATIC SCREW MACHINE.

MUSICAL INSTRUMENTS, ATTACHMENTS, AND MATERIALS

MUSICAL INSTRUMENTS, ATTACHMENTS, AND MATERIALS.

By William F. Worcester.

The census of 1860 was the first to accord special treatment to the manufacture of musical instruments. Subsequently no special report upon the industry was prepared until the census of 1900, when a report entitled "Musical Instruments and Materials" was published. From the census of 1880 to that of 1900, inclusive, the establishments manufacturing this class of products were classified, according to the product of principal value, as follows: "Musical instruments and materials, not specified;" "musical instruments, organs and materials;" and "musical instruments, pianos, and materials."

The manufacture of materials for organs and pianos conducted apart from the establishments producing the finished articles is now a well defined branch of the industry, and accordingly, at the census of 1905 establishments manufacturing materials for organ and piano makers were classified as "musical instruments, organ and piano materials," instead of being merged with the manufacture of organs and pianos, as indicated above. The classifications "musical instruments, organs," and "musical instruments, pianos," of the census of 1905, therefore, are not comparable with the classifications of previous censuses covering the same products, since the latter include also the production of piano and organ materials.

THE COMBINED INDUSTRY.

In Table 1 is presented a combined comparative summary showing the progress of the industry from a statistical standpoint since 1860.

Table 1.—MUSICAL INSTRUMENTS, ATTACHMENTS, AND MATERIALS—COMPARATIVE SUMMARY, WITH PER CENT OF INCREASE: 1860 TO 1905.

	CENSUS.						PER CENT OF INCREASE.				
	1905[1]	1900[2]	1890	1880	1870	1860	1900 to 1905	1890 to 1900	1880 to 1890	1870 to 1880	1860 to 1870
Number of establishments	625	619	674	429	337	223	1.0	[3]8.2	57.1	27.3	51.1
Capital	$72,225,379	$47,706,582	$29,650,489	$14,446,765	$9,554,761	$4,431,900	51.4	60.9	105.2	51.2	115.6
Salaried officials, clerks, etc., number	2,947	1,676	[4]1,332	(5)	(5)	(5)	75.8	25.8	....	....	....
Salaries	$3,979,696	$2,156,371	[4]$1,657,735	(5)	(5)	(5)	84.6	30.1	....	....	....
Wage-earners, average number	35,220	23,714	18,096	11,350	7,167	4,461	48.5	31.0	59.4	58.4	60.7
Total wages	$19,689,146	$12,774,902	$11,648,648	$7,098,794	$5,107,291	$2,378,520	54.1	9.7	64.1	39.0	114.7
Men 16 years and over	33,212	22,398	17,661	10,925	7,001	(5)	48.3	26.8	61.7	56.0	....
Wages	$19,115,547	$12,447,965	$11,499,617	(5)	(5)	(5)	53.6	8.2	....	....	....
Women 16 years and over	1,424	781	352	175	68	(5)	82.3	121.9	101.1	157.4	....
Wages	$454,447	$219,417	$134,034	(5)	(5)	(5)	107.1	63.7	....	....	....
Children under 16 years	584	535	83	250	98	(5)	9.2	544.6	[3]66.8	155.1	....
Wages	$119,152	$107,520	$14,997	(5)	(5)	(5)	10.8	616.9	....	....	....
Miscellaneous expenses	$7,564,994	$3,783,714	$2,394,316	(6)	(6)	(6)	99.9	58.0	....	....	....
Cost of materials used	$29,116,566	$18,576,022	$14,436,163	$8,361,227	$4,834,552	$2,144,298	56.7	28.7	72.7	73.0	125.5
Value of products	$69,574,340	$44,418,978	$36,868,169	$19,254,739	$13,905,908	$6,548,432	56.6	20.5	91.5	38.5	112.4

1 Exclusive of the statistics of 3 establishments engaged primarily in the manufacture of products other than musical instruments, attachments, and materials. These establishments made musical instruments to the value of $69,114.
2 The totals do not agree with those published in the general tables at the Twelfth Census because of a reclassification.
3 Decrease.
4 Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905, but not included in this table.
5 Not reported separately.
6 Not reported.

It is apparent from the table that as early as 1860 the industry had assumed proportions of some importance. At that time there were 223 establishments which produced musical instruments to the value of $6,548,432. Since that date the figures in each census have exceeded those of preceding decades for every item, with the exception of the number of establishments and the number of children employed. At the census of 1900 the number of establishments decreased for the first time. This decrease is in

line with the concentration movement which has characterized so many of the industries in the United States during the past fifteen years. As a result of the movement in this industry, the table shows that since 1890 the operations of the average establishment have practically doubled.

A notable feature of the table is the increase in the industry since 1900. The absolute increase of $25,155,362 in the value of products for the five years is greater by far than the absolute increase for any of the ten-year periods shown, over three times as large as that of the decade preceding, and about equal to that of the twenty years from 1880 to 1900.

In Table 2 the aggregate for the different statistical items at the census of 1905 are distributed by industries.

TABLE 2.—MUSICAL INSTRUMENTS, ATTACHMENTS, AND MATERIALS—SUMMARY, BY INDUSTRIES, WITH PER CENT OF TOTAL: 1905.

	Total.	Pianos.	Per cent of total.	Organs.	Per cent of total.	Piano and organ materials.	Per cent of total.	Instruments and materials not specified.	Per cent of total.
Number of establishments	625	249	39.9	94	15.0	101	16.1	181	29.0
Capital	$72,225,379	$49,649,135	68.7	$7,203,878	10.0	$11,628,897	16.1	$3,743,469	5.2
Salaried officials, clerks, etc., number	2,947	2,068	70.2	323	11.0	331	11.2	225	7.6
Salaries	$3,979,696	$2,846,685	71.5	$372,362	9.4	$508,883	12.8	$251,766	6.3
Wage-earners, average number	35,220	21,002	59.6	3,623	10.3	8,456	24.0	2,139	6.1
Wages	$19,689,146	$12,170,251	61.8	$2,034,559	10.3	$4,322,268	22.0	$1,162,068	5.9
Miscellaneous expenses	$7,564,994	$5,532,420	73.1	$818,276	10.8	$787,475	10.4	$426,823	5.7
Cost of materials used	$29,116,566	$19,587,770	67.3	$2,068,638	7.1	$6,330,219	21.7	$1,129,939	3.9
Value of products	$69,574,340	$46,922,471	67.4	$6,041,844	8.7	$13,128,315	18.9	$3,481,710	5.0

The statistics reveal at a glance the overwhelming importance of the piano industry when compared with the others which compose the combined industry. To the manufacture of pianos, piano players, and attachments were assignable 68.7 per cent of the aggregate capital and 67.4 per cent of the aggregate value of products of the combined industries at the census of 1905. Next in importance was the manufacture of piano and organ materials, which in value of products considerably exceeded the value of the combined output of the two remaining industries. In connection with this branch it should be noted here that, theoretically at least, the entire value of product of the industry is duplicated in the combined aggregate. The products of the establishments comprising the classification must pass through the organ or piano factory, where they are incorporated with other materials to form the final products, and thus their value is included twice in the aggregate value for the four industries. Necessarily, then, as the specialization in the manufacture of pianos and organs increases and the final producers of the instruments become more and more assemblers of parts rather than manufacturers, the duplication in the products of the combined industries will become greater. Since the manufacture of piano and organ parts has not been segregated previous to the present census, it is impossible to draw any inference from the table concerning the growth of this tendency toward specialization in the manufacture of these instruments. Significant and interesting conclusions concerning the growth may be drawn from subsequent censuses, however, in case the values returned for the products of the classification "musical instruments, piano and organ materials" constitute increasing proportions of the values reported for the products of the combined industry.

Many establishments engaged primarily in the manufacture of pianos produce also some organs, while others, whose principal products are organs, manufacture a limited number of pianos. Since the establishments are classified according to the product of greatest value, it is impossible to avoid some intermingling of products. Thus the value of products for the classification "musical instruments, pianos," will include the value of some organs, and the value of products of "musical instruments, organs," will include the value of the pianos produced as products of secondary value by the establishment in this classification.

Table 3 indicates the extent of the intermingling of products at the census of 1905, showing in detail the kind, number, and value of the pianos and organs produced by the establishments in the two industries.

TABLE 3.—*Musical instruments, pianos and organs—products of each industry, by kind, quantity, and value: 1905.*

KIND.	Total.	Pianos.	Per cent of total.	Organs.	Per cent of total.
Aggregate value	$52,964,315	$46,922,471	88.6	$6,041,844	11.4
Pianos, total value	$43,502,055	$42,874,395	98.6	$627,660	1.4
Upright—					
Number	251,957	250,204	99.3	1,753	0.7
Value	$37,397,674	$37,116,668	99.2	$281,006	0.8
Grand—					
Number	7,372	7,372	100.0	....	......
Value	$3,661,423	$3,661,423	100.0	....	......
Other varieties, including street and self-playing, players, and attachments	$2,442,958	$2,096,304	85.8	$346,654	14.2
Organs, total value	$6,625,319	$1,668,493	25.2	$4,956,826	74.8
Reed—					
Number	113,065	43,028	38.1	70,037	61.9
Value	$4,162,053	$1,489,802	35.8	$2,672,251	64.2
Pipe—					
Number	901	75	8.3	826	91.7
Value	$1,989,979	$124,736	6.3	$1,865,243	93.7
Other varieties, including street and self-playing.	$473,287	$53,955	11.4	$419,332	88.6
All other products	$2,836,941	$2,379,583	83.9	$457,358	16.1

The table shows that while only 1.4 per cent of the total value of the output of pianos of all kinds was reported by establishments primarily engaged in the manufacture of organs, practically a quarter, 25.2 per cent, of the value of all the organs produced during the census year resulted from the operations of piano factories. The value of organs built in piano factories, however, formed only 3.6 per cent of the aggregate value of the products of these factories. It is in the manufacture of reed organs that the encroachment of the piano factories upon the field of organ manufacturers is most noticeable, 43,028 of this variety of organs, or 38.1 per cent of the total production, having been produced during the census year by piano manufacturers.

In Table 4 the aggregate of the combined industries in 11 selected states that were large producers of musical instruments at the census of 1905 is shown for the censuses from 1880 to 1905. The remaining states which produced musical instruments at each census period are combined to form "all other states."

Table 4.—MUSICAL INSTRUMENTS, ATTACHMENTS, AND MATERIALS—COMPARATIVE SUMMARY, BY SELECTED STATES: 1880 TO 1905.

STATE.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
				Number.	Salaries.	Average number.	Wages.			
United States	1905	625	$72,225,379	2,947	$3,979,696	35,220	$19,689,146	$7,564,994	$29,116,566	$69,574,340
	1900	619	47,706,582	1,676	2,156,371	23.714	12,774,902	3,783,714	18,576,022	44,418,978
	1890	674	29,650,489	1,332	1,657,735	18.096	11,648,648	2,394,316	14,436,163	36,868,169
	1880	420	14,446,765	....	....	11,350	7,098,794	....	8,361,227	19,254,739
California	1905	15	360,279	19	18,630	110	89,216	32,525	71,281	216,204
	1900	15	96,295	2	2,240	48	34,535	8,093	26,465	111,923
	1890	27	152,360	27	25,915	57	48,576	28,917	58,240	231,349
	1880	12	59,550	....	....	37	27,085	....	45,875	113,100
Connecticut	1905	20	5,230,996	127	240,826	2,585	1,338,150	429,706	2,403,548	5,279,085
	1900	17	3,588,630	84	145,707	1,864	889,973	171,527	1,571,674	3,399,768
	1890	14	1,960,030	51	74,048	1,128	647,762	77,916	1,094,745	2,125,460
	1880	11	745,000	....	....	846	404,294	....	644,144	1,231,520
Illinois	1905	84	17,111,229	780	937,522	7,999	4,233,273	1,624,734	5,604,685	13,997,728
	1900	72	11,516,161	413	506,178	5,100	2,608,062	971,603	3,490,343	8,670,838
	1890	39	3,849,718	116	110,316	2,031	1,083,179	227,478	1,539,782	3,786,299
	1880	23	281,450	....	....	375	217,909	....	336,178	694,975
Indiana	1905	19	3,002,068	220	231,311	1,570	776.106	297,061	1,060,584	2,731,156
	1900	11	1,032,274	82	59,351	656	351,008	97,884	402,295	1,019,535
	1890	12	402,743	29	21,920	261	131,873	39,959	142,531	479,014
	1880	12	162,850	....	....	291	136,350	....	120,400	324,300
Massachusetts	1905	77	8,449,498	299	438,245	4,307	2,565,769	901,529	3,207,222	8,538,073
	1900	95	7,343,625	212	329,533	3,423	2,037,153	541,389	2,476,904	6,640,790
	1890	125	6,158,495	271	361,788	4,077	2,726,247	727,141	3,119,160	8,071,362
	1880	86	3,277,266	....	....	3,074	1,790,548	....	2,173,011	5,056,399
Michigan	1905	20	2,441,878	98	123,583	1,178	585,612	317,979	785,537	2,108,139
	1900	16	1,265,090	64	69,931	793	393,481	130,280	480,431	1,217,552
	1890	11	699,418	32	40,070	582	311,842	66,145	354,865	963,123
	1880	5	141,000	....	....	170	67,050	....	84,677	207,679
Missouri	1905	9	99,534	13	13,330	89	60,414	10,267	44,180	161,614
	1900	15	80,775	5	4,100	66	37,076	7,748	29,264	98,171
	1890	23	87,161	28	19,775	61	39,883	9,042	26,212	116,505
	1880	20	93,450	....	....	42	22,448	....	22,685	75,050
New Jersey	1905	24	2,838,074	148	163,314	1,866	970,310	293.066	1,191,027	2,981,022
	1900	28	2,516,771	105	83,650	1,503	725,822	248,774	927,770	2,211,699
	1890	14	160,152	24	18,602	184	108,189	47,799	152,185	382,574
	1880	11	390,222	....	....	461	179,300	....	231,768	510,000
New York	1905	216	22,247,524	875	1,316,882	10,082	6,175,848	2,519.690	11,253,410	24,277,927
	1900	193	14,313,495	481	688,135	7,244	4,200,754	1,194 288	6,868,284	15,509,839
	1890	211	11,091,456	449	643,325	7,142	5.025,059	685,269	6,160,196	15,713,919
	1880	150	7,132,345	....	....	4,508	3,485,407	....	3,861,225	8,842,249
Ohio	1905	33	3,401,418	120	154,312	2,229	1,215,695	406,678	1,638,037	3,714,255
	1900	34	1,499,872	58	64,022	811	377,341	133.978	731,568	1,521,079
	1890	27	502,623	50	51,827	312	172,229	47,034	224,741	592.885
	1880	14	113,300	....	....	168	66,175	....	66,125	166,940
Pennsylvania	1905	45	2,501,421	95	113,842	1,149	603,180	211,125	703,153	1,961,872
	1900	51	1,828,126	78	99,326	859	492,005	117,875	674,637	1,709,197
	1890	75	1,259,429	114	113,895	694	451,790	163,057	567,658	1,581,624
	1880	29	387,650	....	....	374	201,954	....	193,720	502,785
All other states	[1] 1905	63	4,451,460	153	227,899	2,056	1,075,573	520,634	1,153,902	3,607,265
	[2] 1900	72	2,625,468	92	104,198	1,347	627,692	160,275	896,387	2,308,587
	[3] 1890	96	3,326,904	141	176,254	1,567	902,019	274,559	995,848	2,824,055
	[4] 1880	56	1,662,682	....	....	1,014	500,274	....	581,419	1,529,742

[1] Includes establishments distributed as follows: Colorado, 3; Delaware, 1; Georgia, 1; Iowa, 3; Kansas, 2; Kentucky, 7; Louisiana, 2; Maine, 2; Maryland, 11; Minnesota, 9; Nebraska, 2; New Hampshire, 4; Oregon, 1; Rhode Island, 1; Vermont, 3; Virginia, 1; Washington, 3; West Virginia, 1; Wisconsin, 6.

[2] Includes establishments distributed as follows: Colorado, 4; Iowa, 7; Kentucky, 8; Louisiana, 1; Maine, 1; Maryland, 11; Minnesota, 12; Nebraska, 2; New Hampshire, 6; Oregon, 1; Rhode Island, 3: Tennessee, 1: Texas, 3; Vermont, 3; Virginia, 1; Washington, 1; Wisconsin, 7.

[3] Includes establishments distributed as follows: Arkansas, 1; Georgia, 7; Iowa, 1; Kansas, 2; Kentucky, 11; Louisiana, 6; Maine, 4; Maryland, 16; Minnesota, 8; Nebraska, 1; New Hampshire, 7; North Carolina, 1; Rhode Island, 4; South Carolina, 1; Tennessee, 1; Texas, 7; Vermont, 5; Virginia, 3; Wisconsin, 10.

[4] Includes establishments distributed as follows: Delaware, 1; District of Columbia, 1; Georgia, 1; Iowa, 1; Kansas, 1; Kentucky, 6; Maine, 5; Maryland, 13; Minnesota, 6; New Hampshire, 8; North Carolina, 1; Rhode Island, 1; Tennessee, 2; Texas, 1; Vermont, 3; Virgina, 1; Wisconsin, 4.

Throughout the twenty-five years covered by the table the state of New York has been the leader in the production of musical instruments, and at the end of the period produced instruments, materials, etc., valued at nearly twice that of the output of the state second in importance, Illinois. The progress of the latter state in the industry, however, has been remarkable. At the census of 1880 the manufacturers of musical instruments in Illinois produced an output valued at only $694,975 and twenty-five years later an output valued at $13,997,728, or an increase in value of nearly nineteenfold during the period. At the census of 1880 Massachusetts was a fairly close second in the industry, but since that date has made comparatively slight gains, with the result that by 1900 the state was supplanted by Illinois, dropping to third place, which position the state maintained at the census of 1905. At the census of 1905 Ohio ranked fourth in the value of products, with an output valued at $3,714,255, which represented an increase of more than twenty-one fold over the value reported in 1880.

The development of the export and import trade in musical instruments is compared in Table 5 with the growth in the industry in the United States as measured by the value of the products reported at each census from 1870 to 1905.

TABLE 5.—*Musical instruments, attachments, and materials—value of exports and imports compared with value of domestic production: 1870 to 1905.*

CENSUS.	Value of domestic production.	EXPORTS.[1]		IMPORTS.[1]	
		Value.	Per cent of domestic production.	Value.	Per cent of domestic production.
1905	$69,574,340	[2] $3,230,982	4.6	[2] $1,366,285	2.0
1900	[3] 44,514,463	1,958,779	4.4	1,090,541	2.4
1890	36,868,169	1,105,134	3.0	1,703,129	4.6
1880	19,254,739	811,177	4.2	917,778	4.8
1870	13,905,908	267,400	1.9	[4] 1,050,218	7.6

[1] Bureau of Statistics, Department of Commerce and Labor, "Commerce and Navigation of the United States."
[2] Fiscal year ending June 30, 1904.
[3] Includes products valued at $95,485 not included in the general tables.
[4] Figures are for 1872, the first year musical instruments were reported separately.

The percentages in the table should not be considered without some important reservations. The fact that there are large duplications of value, as set forth in the discussion of Table 2, in the census totals forbids the use of the percentages except as an indication of general tendencies. An additional reason for care in this respect is the fact that the figures for exports and imports cover fiscal years, whereas census values cover calendar years, with the exception of 1900, when the census year ended May 31. The table indicates, then, that while the ratios of the value of imports of musical instruments to the value of such products manufactured in the United States have steadily decreased for the census years since 1870, the corresponding ratios of the value of exports of the same nature have increased for this period. The value of products manufactured increased fourfold, the value of exports elevenfold, while the value of imports increased only 30.1 per cent. At the census of 1870 foreign manufacturers sold to this country musical instruments valued at nearly four times as much as the manufacturers of these products in the United States shipped to foreign countries, but at the census of 1905 this condition was reversed and the value of exports was over twice as great as the value of imports of musical instruments.

Foreign markets are being more and more closely studied by musical instrument manufacturers, especially by piano and organ makers. When an instrument is designed to be shipped to some portion of the tropics, the woodwork is coated with a moisture-resisting varnish, veneer is avoided, all glued work is reenforced, felt parts are dipped in a poison solution to prevent ravages of insects, and other precautions tending to the preservation of the instruments are taken.

Undoubtedly the exports of musical instruments would be much greater were it not that piano and organ manufacturers have in some instances found it more advantageous to establish branch factories abroad, to carry out the ideas and methods of American production gauged to suit the requirements of the foreign trade, thus saving duties and obtaining the advantage of less expensive labor.

In the sections which follow, statistics of capital, labor, materials, etc., are omitted, the foregoing tables in this section presenting the essential details concerning these particulars. Moreover, the detailed summaries at the close of this report present the statistics for each industry in as refined a form as the statistical returns for the manufacture of musical instruments allow.

The following pages show the production of the various musical instruments, attachments, and materials, by kind and value, in as great detail in each case as conditions permit, and indicate the distribution of the production among the states, together with the principal centers of each industry within the states. In addition, matter descriptive of the different varieties of instruments and of the latest forms which have appeared is included.

PIANOS.

The statistics in this section include the manufacture of finished pianos of all kinds, also self-playing and street pianos, cabinet piano players, and piano playing attachments. The manufacture of piano materials, apart from factories reporting the finished instruments, having grown to be a considerable industry in itself, is presented separately in a later section.

The piano manufacturer generally buys certain portions of his instruments ready made, inasmuch as fac-

tories equipped for manufacturing certain parts can generally make them more economically than a piano factory. Some makers, however, manufacture the principal parts of their pianos, even selecting the wood that enters into the construction of the instrument. In compiling statistics relating to the industry it has been impossible for the Census Office to recognize any distinction of this kind.

Table 6 presents a comparative summary of the value of the different varieties of pianos manufactured in the United States as reported at the censuses of 1900 and 1905, showing the percentage each class is of the total value and the per cent of increase during the five-year period.

TABLE 6.—*Pianos, including piano players and attachments—kind and value, with per cent of total and per cent of increase: 1905 and 1900.*

KIND.	1905		1900[1]		Per cent of increase.
	Value.	Per cent of total.	Value.	Per cent of total.	
Total	[2] $43,527,543	100.0	$27,692,160	100.0	57.2
Upright pianos	37,397,674	85.9	25,294,297	91.4	47.9
Grand pianos	3,661,423	8.4	1,701,420	6.1	115.2
Square pianos	12,150	(3)	28,950	0.1	[4] 58.0
Self-playing and street pianos, piano players, and attachments	2,456,296	5.7	667,493	2.4	268.0

[1] Represents value of pianos, etc., reported by all classes of establishments.
[2] Includes piano players valued at $25,488, made by establishments engaged primarily in the manufacture of piano and organ materials.
[3] Less than one-tenth of 1 per cent.
[4] Decrease.

At the census of 1905, compared with that of 1900, the proportion which the value of upright pianos formed of the value of all products shown in the table decreased, while the proportions which the value of grand pianos and the group of instruments including self-playing and street pianos, piano players, and attachments, formed of the total value increased. This was due to the rapid increase in the value of grand pianos and the last-named group, which increased at a much greater rate than the value of upright pianos.

Grand pianos were manufactured in 1905 to a value of $3,661,423, or 8.4 per cent of the total value reported for all products and attachments, and an increase of 115.2 per cent over the value reported in 1900, which constituted 6.1 per cent of the total value for all classes of pianos, players, and attachments. Piano players and attachments show the remarkable increase of 268 per cent in value of product reported. The growing importance of this class of products has been a feature of the piano industry during the past five years, and the manufacture of the group of instruments composing it has been accorded separate treatment in another section of this report.

Excluding the product of square pianos, piano players and attachments, Table 7 shows the number and value of upright and grand pianos manufactured in selected states in 1905 in comparison with the census of 1900, together with the percentage the value of product reported for each state is of the United States total.

TABLE 7.—*Pianos, upright and grand—number and value, with per cent of total value, by states: 1905 and 1900.*

STATE.	Census.	UPRIGHT PIANOS.			GRAND PIANOS.		
		Number.	Value.		Number.	Value.	
			Amount.	Per cent of total.		Amount.	Per cent of total.
United States	1905	251,957	$37,397,674	100.0	7,372	$3,661,423	100.0
	[1] 1900	166,786	25,294,297	100.0	4,251	1,701,420	100.0
Connecticut	1905	9,152	1,210,692	3.2	19	7,425	0.2
	1900	7,259	941,344	3.7	10	3,650	0.2
Illinois	1905	73,874	9,605,681	25.7	238	81,711	2.2
	1900	46,024	5,643,287	22.3	110	48,460	2.9
Massachusetts	1905	20,967	4,022,237	10.7	2,159	1,107,596	30.3
	1900	15,872	3,177,217	12.6	937	389,445	22.9
New York	1905	96,985	14,505,035	38.8	3,541	1,865,194	50.9
	1900	69,191	10,876,742	43.0	2,581	962,865	56.6
Ohio	1905	11,119	1,782,910	4.8	160	72,700	2.0
	1900	8,696	1,150,293	4.5	166	63,775	3.7
All other states	[2] 1905	39,860	6,271,119	16.8	1,255	526,797	14.4
	[3] 1900	19,744	3,505,414	13.9	447	233,225	13.7

[1] Represents number and value of pianos reported by all classes of establishments.
[2] Includes states as follows: California, Colorado, Indiana, Kentucky, Louisiana, Maine, Maryland, Michigan, Minnesota, Missouri, Nebraska, New Hampshire, New Jersey, Pennsylvania, West Virginia, Wisconsin.
[3] Includes states as follows: California, Colorado, Indiana, Kentucky, Maine, Maryland, Michigan, Minnesota, Missouri, Nebraska, New Hampshire, New Jersey, Pennsylvania, Tennessee, Vermont.

Table 7 shows that 85,171 more upright pianos and 3,121 more grand pianos were manufactured in the United States during the year ending December 31, 1904, than during the year covered by the census of 1900. At the census of 1905, establishments located in the state of New York reported the manufacture of 96,985 upright pianos, or more than one-third of the entire number reported for the United States. New York city is the principal center in the United States for the manufacture of pianos; 82,532 uprights and nearly all the grands reported for the entire state were manufactured in that city, the aggregate product being greater than that reported for any state other than New York.

At both censuses shown in the table, Illinois ranked second in the production of upright pianos. Chicago is the great center of the industry in this state, and at the census of 1905, 42,933 upright pianos were reported by manufacturers at Chicago.

In the manufacture of upright pianos Massachusetts ranks as the third state, with a production valued at $4,022,237, an increase of 26.6 per cent over the value reported for 1900. Boston, the third city in the United States in the piano industry, reported the manufacture of 12,989 uprights and grands during 1904, to a total value of $3,266,177. Cambridge, Mass., also manufactured pianos to a considerable extent.

The concentration of the manufacture of upright pianos in the 3 leading states is marked, but the table indicates a slight decline in this respect. At the census of 1900, 77.9 per cent of the total number of upright pianos produced were manufactured in these 3 states, but by 1905 this proportion had decreased to 75.2 per cent. In the manufacture of grand pianos New York and Massachusetts produced 79.5 per cent of the total number reported at the census of 1900. The ascendancy of these 2 states in the manufacture of this variety of pianos has increased, since in 1905 the proportion increased to 81.2 per cent.

In 1900 there were manufactured in the United States 101 square pianos, valued at $28,950. In 1905, as far as manufacturing was concerned, the square piano was practically obsolete. There were, however, 43 square pianos made in the United States during the census year, by 3 companies upon special order, with a total value of $12,150.

The grand is conceded to be the superior instrument as regards tonal quality and musical results, but the upright is the more popular type, in that it occupies less space and is not as expensive as the grand. The apparent difference between the two is the horizontal position of the frame, sounding board, and strings of the former, as compared with the vertical construction of the latter, but the essential and most important differences are the greater length of strings, larger sounding board, and action method of the grand piano in comparison with that of the upright instrument. Piano manufacture has become standardized to a great extent, the same style piano of different factories usually possessing but few distinguishing outer characteristics other than the name on the fall board. Although practically similar in design, there is, however, a great difference between the high grade pianos and those of a lower grade. This difference is not only in the quality of materials and workmanship, but in the tonal results obtained through the expert assembling and regulating of the various parts into the perfect instrument. The best manufacturers thoroughly inspect every piano before it is allowed to leave the shop. This painstaking care and steadfast regard for the quality of each instrument has come to be recognized and appreciated, not only by dealers and agents, but by the purchasing public.

There are many dealers in musical instruments that have pianos made for them under contract with manufacturers who turn out what is known by the trade as the stencil piano, any name desired being placed on the plate, the dealer generally assuming the responsibility for the qualities of the piano.

In recording the various steps in the manufacture of a high grade piano the selection and seasoning of the various kinds of wood is the first and one of the most important. Only those grains and textures are used which have been found to possess the resonant quality necessary for the production of the desired tones. The wood used is almost entirely of American growth, the only notable exceptions being the expensive veneers for the case and the ebony for the black keys. The seasoning of this lumber requires several years, as the condition of the wood is a very important consideration in obtaining the best results.

This seasoned wood is sawed into widths, and the parts are usually made of a number of these widths fitted and glued together in order to withstand the influence of atmospheric changes, to obtain the best tonal results, and to add to the strength. Very few metal bolts or screws are used in the manufacture of a piano, even the timbers of the framework being glued together under heavy pressure. It is found that better results are thus obtained, as the glue properly applied makes a permanent joint, whereas bolts or screws are liable to work loose in their fittings.

The heavy wooden framework of a grand piano and that of an upright are necessarily different in form and construction, but the principles used are the same, for the solid, massive construction of the frame must assist the metal plate in bearing the strain of the strings.

The plate is a casting of metal, principally iron, and is made to fit over the frame. This portion of the piano is very generally manufactured by foundry and machine shops which make a specialty of piano plates and piano hardware. The smoothing down, machine drilling, and finally the bronzing and japanning of the plate are the important operations in the preparation of this casting for use in the pianos.

The spruce pine used in the sounding board is the subject of most careful selection, and the building of this slightly convex and highly sensitive wooden surface and the arrangement of the bridges may be considered among the delicate features of piano manufacture.

The sound production is caused by string vibration, and the wire used, necessarily of great elasticity and of highest grade, is in some instances purchased abroad. The laying out of the scale, arranging the length and weight of wire according to absolute rule, requires expert ability as well as genius. The action, or striking mechanism, the carefully balanced key, the felt covered hammers and dampers, and many other delicately adjusted parts include numerous perfected contrivances. Toning or voicing the piano to produce the tone shadings required is done by softening the felt of the hammers with needles.

The setting up or assembling of the instrument, and the regulating of the many parts to make a harmonious whole is the next step in piano manufacture. The sounding board and plate are attached to the framework, the wires are properly strung and chipped or tuned in a preliminary manner, the keyboard and action are then set in and adjusted, the final tuning of the strings is gone over by experts, and the combined results carefully tested.

Great care is expended in the finish of the case, inasmuch as the instrument is designed to please the eye as well as the ear. It is varnished, sandpapered, and rubbed until a highly polished surface is obtained. Foreign taste prefers the dull finish, and by many this is considered more artistic.

ORGANS.

This instrument is of two principal types, the reed organ, or melodeon, and the pipe organ, the former type being a free reed instrument in which musical tones are produced by thin tongues of brass or steel set in vibration by currents of air, while the latter instrument has a series of pipes of different materials, size, and construction, in which columns of compressed air are caused to vibrate, producing tones of great purity and volume. The ordinary reed organ is small and comparatively inexpensive, while the pipe organ is a much larger instrument and considerably different in structure, and capable of far greater volume and variation in character of tone.

The organ produces a sustained tone which endures as long as the air passage leading to the particular reed or pipe, controlled by the depression of a key, is kept open, admitting a current of air; whereas the tone of a piano continues only during the natural vibration of the string. The forms and measurements of the keyboards of both styles of organs and the piano conform to the same standard, and the music is for the most part interchangeable.

In playing the reed organ the feet are generally used to operate the bellows, while with the pipe organ, which is always provided with hand, mechanical, or other blowing apparatus, the feet are used to manipulate a pedal clavier arranged to command certain pipes and combinations in the same manner as the manual claviers are arranged to command the other pipes and combinations.

Statistics concerning the value of reed organs, pipe organs, and street and self-playing organs manufactured during 1900 and 1904 are shown in Table 8, together with the per cent each class is of the total valuation and the per cent of increase during the five-year period.

TABLE 8.—*Organs—kind and value, with per cent of total and per cent of increase: 1905 and 1900.*

KIND.	1905		1900[1]		Per cent of increase.
	Value.	Per cent of total.	Value.	Per cent of total.	
Total	[2] $6,774,433	100.0	$5,689,033	100.0	19.1
Reed organs	4,212,953	62.2	4,088,073	71.9	3.1
Pipe organs	2,088,193	30.8	1,188,696	20.9	75.7
Street and self-playing organs, and other varieties	473,287	7.0	412,264	7.2	14.8

[1] Represents value of organs reported by all classes of establishments.
[2] Includes reed and pipe organs valued at $149,114 made by establishments engaged primarily in the manufacture of other products; of this value, $69,114 represents organs made in establishments other than musical instruments, attachments, and materials.

The principal feature of the table is the increase since 1900 in the value of pipe organs manufactured. This increase, however, was not sufficient to place the manufacture of pipe organs on the same plane of importance as that of reed organs, which dominated the industry at both censuses, although to a decreasing extent.

Statistics regarding the number and value of reed organs for the United States and selected states are given in Table 9, for the censuses of 1900 and 1905.

TABLE 9.—*Reed organs—number and value, with per cent of total value, by states: 1905 and 1900.*

STATE.	Census.	Number.	VALUE.	
			Amount.	Per cent of total.
United States	1905	[1] 114,675	$4,212,953	100.0
	1900	[2] 107,830	[2] 4,088,073	100.0
Illinois	1905	57,219	1,787,220	42.4
	1900	53,643	1,715,876	42.0
Indiana	1905	3,835	145,476	3.5
	1900	3,697	173,339	4.2
Massachusetts	1905	2,073	150,883	3.6
	1900	3,323	190,582	4.7
Michigan	1905	12,381	511,009	12.1
	1900	9,624	397,198	9.7
Ohio	1905	1,949	94,577	2.3
	1900	1,643	98,572	2.4
Pennsylvania	1905	5,715	242,059	5.7
	1900	6,240	275,438	6.7
All other states	[3] 1905	31,503	1,281,729	30.4
	[4] 1900	29,660	1,237,068	30.3

[1] Includes 1,610 reed organs, valued at $50,900, reported by establishments engaged primarily in the manufacture of products other than musical instruments, attachments, and materials.
[2] Represents number and value of reed organs reported by all classes of establishments.
[3] Includes states as follows: Connecticut, Kentucky, Maryland, Minnesota, New Jersey, Oregon, Vermont, West Virginia.
[4] Includes states as follows: Connecticut, Maryland, Minnesota, New Jersey, New York, Vermont, Virginia.

The table shows a marked localization of the industry in Illinois, the value of the reed organs manufactured in this state at the census of 1905 constituting 42.4 per cent of the aggregate value reported for the entire United States. In Illinois the industry is localized principally in Chicago, which produced 37,622 reed organs, or 65.8 per cent of the number manufactured in the state at the census of 1905. Evidently the middle West is the principal seat of the production of reed organs, for Michigan, Indiana, and Ohio also reported a large production of these instruments, the combined value of the products of the 4 states at the census of 1905 constituting 60.2 per cent of the value of the total production for the United States. In both Massachusetts and Pennsylvania the production of reed organs is declining.

The American reed organ, with perhaps a single exception, is a suction instrument, while the harmonium, or European style of reed organ, operates with air pressure. About 1635, a harmonium maker in Paris invented the suction instrument, but the first of this class of organs manufactured in the United States was made in Boston. These have since become known as

the American reed, or cabinet, organs, although at first designated as melodeons. Rapid progress has been made in the construction of the American reed organ, and it is to-day recognized as a special type of instrument, all organs of this kind now built or used abroad being designated "American organs."

Each reed organ possesses a series of stops controlling individual sets of reeds, and these stops, when drawn, cause the different combinations of tones desired. When the stops are drawn, the pressure on the key opens a pallet or valve permitting the passage of air through the reed cell, causing the reed to vibrate and produce its characteristic note. The reeds are vibratory tongues of brass or steel riveted upon perforated metallic plates, and placed in separate wooden cells made on the edges of what is called the reed board, which latter rests upon the top of the wind chest directly under the keys. There may be more than one set of reeds, and in that case one is placed in front of the other on the reed board, or if more than two, they are placed one over the other. The air pressure is ordinarily produced by a pair of exhausters, operated by the foot pedals, which exhaust the air from a reservoir under a spring tension passage communicating between this reservoir and the air chambers of the instrument containing the valve mechanism.

In addition to the keys, stops, and pedals, there are one or sometimes two knee swells or divided couplers, as they are sometimes called, whereby reeds an octave above or below the keyboard center are caused to sound in addition to the reeds directly connected with the depressed keys. Thus in operating an organ various stops and devices are used to increase or diminish quantity and to vary the character of the tone, inasmuch as no control is possible from the pressure on the keys other than to open the passage of air to certain reeds.

The timbre, or quality, of the tone is regulated by the opening in which the reed vibrates and by the size and form of the channel above the reed and its pallet hole through which the air passes, straining due to excessive or uneven operation of the foot pedal being obviated by a discharge pallet acting as a safety valve. The voicing and tuning are very important operations, the latter being obtained by filing or scraping the tongue of the reed and the former by twisting the tongue into certain curves which determine the quality of tone. The reed organ seldom gets out of tune, inasmuch as it is not susceptible to changes in temperature and atmospheric conditions.

The manufacture of the reed organ, like that of other musical instruments, is largely the result of experience and development. Probably the manipulation of the tongue of the reed to a proper size and curve and the determining of the size of the reed cells, etc., and the length and size of the qualifying cells, when such are used, are the most delicate of the intricate operations involved in its manufacture.

The vocalion is a reed organ approaching somewhat a pipe organ in its characteristic tone quality. Vocalion instruments are largely used in churches, and usually have a pedal base and often two manual claviers, or keyboards, conforming in appearance to the pipe organ. The difference between the ordinary reed organ and the vocalion is that in the latter the air current passes through qualifying cells and tubes before or after reaching the reeds.

There have also been manufactured a combination pipe and reed organ, desk and reed organ, and other somewhat unusual compound forms of the instrument. Almost all the materials used in reed organ construction are strictly American products, with the exception of ivory and ebony. Very little ivory is now used on the keyboard of reed organs, celluloid being substituted in its place, while a stained wood is generally used instead of ebony for the black keys. Very little expensive veneer is used on these instruments, unless by special order, as it greatly increases the cost of the instrument. Unlike the average piano manufacturer, organ makers usually manufacture all parts of their instrument with the exception of reeds and keys, the making of which is really a separate industry.

Statistics of pipe organ production in this section do not include instruments fitted with devices for automatic playing, inasmuch as these will be included under the head of self-playing instruments. Table 1[illegible] presents the number and value of pipe organs built in selected states, and shows the per cent the value of products for each state is of the total value reported for the United States at the censuses of 1900 and 1905.

The number of pipe organs manufactured is not great, but as a rule they are large and comparatively expensive. The table indicates that their production is not centered to a very marked degree in any one state. The value of the organs produced in Massachusetts at the census of 1905 formed 24.9 per cent of the total value for the United States, but both Illinois and Ohio contributed largely to the total, and the numerical output in the case of Ohio equaled and in the case of Illinois exceeded that of the leading state. The average value of the organs built by Massachusetts makers was, therefore, considerably larger than that of the organs manufactured in either Illinois or Ohio. Boston is one of the chief centers for the manufacture of high-grade pipe organs, 60 of these instruments having been built in this city during 1904, with a value of $313,220, a greater valuation than was reported by any state in the United States other than Massachusetts. Pipe organs were also made in Springfield, Waltham, and Cambridge, Massachusetts.

In Illinois, Chicago reported about two-thirds of the total value of pipe organs manufactured in this state, while in Ohio, which has advanced rapidly in

this manufacture, Pomeroy, Alliance, and Cleveland produce the greater part of the pipe organs manufactured in the state. Vermont, Pennsylvania, Maryland, New York, and Connecticut are the next 5 states, ranked according to value of pipe organs built during 1904. Neither Vermont nor Connecticut can be shown in the table, as to do so would reveal individual operations.

TABLE 10.—*Pipe organs—number and value, with per cent of total value, by states: 1905 and 1900.*

STATE.	Census.	Number.	VALUE.	
			Amount.	Per cent of total.
United States	1905	[1] 936	[1] $2,088,193	100.0
	1900	[2] 572	[2] 1,188,696	100.0
Illinois	1905	165	310,323	14.9
	1900	87	105,157	8.8
Maryland	1905	79	166,186	8.0
	1900	50	80,035	6.7
Massachusetts	1905	137	520,887	24.9
	1900	137	365,510	30.8
New York	1905	58	133,471	6.4
	1900	73	216,120	18.2
Ohio	1905	137	251,486	12.0
	1900	23	34,250	2.9
Pennsylvania	1905	87	175,555	8.4
	1900	80	150,990	12.7
Wisconsin	1905	22	45,214	2.2
	1900	8	15,475	1.3
All other states	[3] 1905	251	485,071	23.2
	[4] 1900	114	221,159	18.6

[1] Includes 35 pipe organs, valued at $98,214, made by establishments engaged primarily in the manufacture of other products. Of this value, $18,214 represents pipe organs made by establishments other than musical instruments, attachments, and materials.

[2] Represents number and value of pipe organs reported by all classes of establishments.

[3] Includes states as follows: California, Connecticut, Delaware, Indiana, Iowa, Kentucky, Maine, Michigan, Minnesota, Missouri, New Jersey, Rhode Island, Vermont.

[4] Includes states as follows: California, Colorado, Connecticut, District of Columbia, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, Rhode Island, Texas.

The pipe organ is often spoken of as being the largest, most expensive, and most perfect of all musical instruments, and the methods of its manufacture are of considerable interest. Almost every pipe organ is practically built to order to accord with the architecture or acoustic qualities of the room or auditorium in which it is designed to be placed. The ornamental work of the pipe organ is sometimes put in by the building contractors, who are in no way identified with the organ builders.

One complete stop of one rank of pipes in the modern organ consists of 61 notes for the manual clavier and 32 for the pedal clavier, and there are as many stops as may be desired according to the size and cost of the organ; in some instances there are 100 or more. These pipes are made of wood or metal, the wood being carefully selected of various growths, and the metals, chiefly zinc, tin, and lead, being used in alloys according to the different qualities of tone desired. The arranging of the shape and size of the pipes is an operation in which experience and knowledge on the part of the builder are necessary to the manufacture of a successful instrument. The voicing and tuning of these pipes are invariably done before they are set up in the organ, and this operation is of great delicacy. Final tuning and regulating are done after the pipes are placed in the finished instrument.

The bellows of a pipe organ must be of exactly sufficient capacity to feed all the pipes, and therefore varies in construction according to the size of the organ. The operation of the bellows may be by hand, by hydraulic power, or by electricity, in which latter instance a current of from 100 to 200 volts in strength is necessary. There is an electric fan feeder recently patented which is said to be very successful in operation and which takes up much less room than the ordinary class of feeders, but the ordinary compound bellows is used in the majority of organs, and almost altogether in those built in 1904. The air does not pass directly to the pipes, but is generally led first into a regulator bellows, which makes the pressure more even and regular in strength, after which it is conveyed to the wind chest, and is then caused to pass into the pipes by the opening of valves controlled by the key or playing mechanism.

The tracker organ, in which the pallets or valves leading from the wind chest to the pipes are opened direct from the keys by means of trackers or levers, has been largely superseded by the more modern pneumatic and electric action, although there are many of the older style still in use, and some builders still make small tracker organs. During 1904 the principal pipe organ action used was of the tubular pneumatic type, in which the depression of the keys opens certain valves, causing air pressure to open larger valves, admitting the air from the wind chest to the pipes.

Probably the most recent development in pipe organ construction is the electric action, which is operated either by a storage battery or by a small generator connected with the bellows motive power. Depression of a key causes electrical contact, allowing the current to pass through a magnet in the wind chest or pallet box, which magnet operates a primary valve connected with a larger valve, which, being open, allows passage of air, thereby causing the pipe to speak. Each key of both manual and pedal claviers is fitted with this arrangement of magnet, air cells, valves, etc., and the action is simultaneous with the pressure on the key or pedal. The use of electricity in the action mechanism allows the instrument to be played with an even and light pressure on the keys, whereas, in the older style tracker organ, to operate some combinations required considerable strength. Another advantage in an electrically operated organ is that the key case, or console, may be placed at any distance from the organ proper, inasmuch as the power is transmitted by wires to the valve mechanism con-

nected with the pipes. This arrangement is also possible in the exclusive tubular pneumatic organ, although the distance capable of being covered is necessarily somewhat limited.

SELF-PLAYING AND STREET PIANOS AND ORGANS, AND PIANO PLAYERS AND ATTACHMENTS.

The statistics concerning the kind and value of self-playing and street pianos and organs, cabinet piano players, and playing attachments, presented in preceding sections in connection with the manufacture of pianos and organs, are shown in greater detail in the three tables following. Table 11 is a comparative summary showing the value reported for each class during 1900 and 1905, with the per cent of increase during the five-year period and the per cent each class is of the total value.

TABLE 11.—*Self-playing and street pianos and organs, and piano players and attachments—kind and value, with per cent of total and per cent of increase: 1905 and 1900.*

KIND.	1905		1900		Per cent of increase.
	Value.	Per cent of total.	Value.	Per cent of total.	
Total	[1] $2,929,583	100.0	$953,772	100.0	207.2
Piano players and piano playing attachments	2,029,754	69.3	607,873	63.7	233.9
Self-playing pianos and organs	849,813	29.0	317,569	33.3	167.6
Street pianos and organs	50,016	1.7	28,330	3.0	76.5

[1] Includes piano players valued at $25,488 made by establishments engaged primarily in the manufacture of piano and organ materials.

Large increases are shown for each group of products, but the leading feature of the table is the increase since 1900 of 233.9 per cent in the manufacture of piano players and attachments, which indicates the growing popularity of automatic piano playing.

Table 12 presents the number and value of piano players and piano playing attachments manufactured in the United States at the censuses of 1900 and 1905 and the per cent each class is of the total value at both censuses.

TABLE 12.—*Piano players and piano playing attachments—number and value, with per cent of total value: 1905 and 1900.*

KIND.	Census.	Number.	VALUE.	
			Amount.	Per cent of total.
Total	1905	[1] 20,634	[1] $2,029,754	100.0
	1900	[2] 6,158	[2] 607,873	100.0
Piano players	1905	17,652	1,876,974	92.5
	1900	5,236	520,139	85.6
Piano playing attachments	1905	2,982	152,780	7.5
	1900	922	87,734	14.4

[1] Includes 243 piano players, valued at $25,488, made by establishments engaged primarily in the manufacture of piano and organ materials.
[2] Represents number and value of piano players and piano playing attachments reported by all classes of establishments.

According to the census designation, the piano player is a separate cabinet instrument which must be attached to a piano to be used. The value of product reported for this class of automatic players in 1905, as compared with 1900, increased 260.9 per cent. Connecticut ranks first in the manufacture of these instruments, with Meriden as the center, while New Jersey, Michigan, New York, and Illinois are respectively the second, third, fourth, and fifth states in order of principal production.

Piano playing attachments, or interior players, as they are sometimes called, were manufactured to a considerable extent at the census of 1905, when a product valued at $152,780 was reported, an increase of 74.1 per cent over the $87,734 reported in 1900. The state of New Jersey reports the principal production of interior players, with New York and Connecticut second and third in rank. The piano playing attachments thus reported do not include the entire product, inasmuch as there were manufactured 2,569 self-playing pianos and organs, as shown in Table 13, the value of which includes the value of the self-playing mechanism contained in the instrument.

Table 13 presents the number and value of self-playing pianos and organs manufactured in the United States as reported at the censuses of 1900 and 1905, with the per cent each is of the total value reported at each census.

TABLE 13.—*Self-playing pianos and organs—number and value, with per cent of total value: 1905 and 1900.*

KIND.	Census.	Number.	VALUE.	
			Amount.	Per cent of total.
Total	1905	2,569	$849,813	100.0
	1900	1,962	317,569	100.0
Self-playing pianos	1905	1,868	417,382	49.1
	1900	224	44,745	14.1
Self-playing organs	1905	701	432,431	50.9
	1900	1,738	272,824	85.9

The great advance in the last five years in the manufacture of pianos containing self-playing mechanism is shown by the fact that the value of these instruments increased from $44,745 to $417,382, or 832.8 per cent, during the period. New York state leads in this manufacture, reporting 1,506 self-playing pianos, valued at $314,682, or 75.4 per cent of the total value of products. New Jersey, Missouri, Connecticut, and Illinois also report the manufacture of self-playing pianos, ranked in the order named. The total number of piano players, piano playing attachments, and self-playing pianos shown by Tables 12 and 13 was 22,502, compared with 6,382 reported in 1900, which comparison indicates the increased use of all kinds of piano playing mechanism, and doubtless another census will show a still greater advance, inasmuch as

public attention is being turned in this direction by the satisfactory results obtained by these devices.

The value of the self-playing organs manufactured increased during the five years, but the number decreased. This decrease in number is explained by the fact that these instruments are now largely of the pipe organ variety, which are more expensive than reed organs, the latter not being fitted with playing mechanism to as great an extent as in 1900, attention being directed more to piano playing devices. In the manufacture of self-playing organs New Jersey ranks first, Massachusetts second, and New York third, while 8 other states also show a product of this style of musical instruments.

Piano players and playing attachments are becoming quite numerous, and many ingenious devices have been invented. The cabinet player, with felt plungers to strike the keys of the ordinary piano, was the first to be generally used and is still very popular, especially for use in playing a grand piano. Most of the instruments and attachments are now operated primarily by pneumatic pressure or suction, or by a combination of pneumatic and electric action. The air, passing through the holes of the perforated music paper running over corresponding holes in a tracker board, is communicated, usually by means of rubber tubes, to the playing mechanism. There are, however, ingenious electric devices for automatic piano playing which have been prominently displayed and are now being manufactured, but during the year 1904 the action used in playing mechanism was principally pneumatic.

The organ lends itself more readily to automatic playing because of its valvular arrangement, the quantity and quality of tone being controlled by stops and knee swells, rather than by the strength and character of stroke, as in piano playing. The wind motor furnishing pneumatic pressure or suction may be operated by electricity, an ordinary storage battery being generally used to furnish the current required, which is not more than from 4 to 8 volts in strength. In a self-playing organ the automatic mechanism, by means of this pneumatic action, controls the organ action in technically the same manner that it would if played by hand, except that the air control does not operate the keys but is taken directly to the valves which ordinarily would be controlled by the keys. It is claimed that there are no effects possible to organ playing by hand which may not be obtained by self-playing mechanism under expert guidance, and it may readily be seen that orchestral arrangements too complex for one organist can be executed by the playing attachment.

The piano case containing a playing attachment is so constructed that when closed up it is an ordinary piano which can be played by hand. If it is desired to use the instrument automatically, a panel in the upper part of the case may be opened and a roll of music fitted in and attached to run over the tracker board and wind on a receiving spool. By letting down a hinged panel in the lower portion of the instrument, the pedal arrangement is disclosed by means of which wind power may be provided to operate the bellows furnishing pneumatic power to the playing mechanism. Thus the upright piano is in this combination instrument capable of being operated either by hand or by automatic action.

Expression is put into the automatically played music by means of levers, and accellerando and ritardando as well as forte and pianissimo effects are thus obtainable, and modern devices enable individual notes or a certain air to be made prominent with the accompaniment subdued. This ability to bring out a theme or melody is a new power which has been given the automatic instrument.

An electric playing mechanism using about one-third the power of a small incandescent lamp has been recently put on the market, but none was reported as manufactured during 1904, except in experimental work. This apparatus does away with the necessity of pumping a bellows, and is considered successful not only in convenience and correct operation but the claim is also made that music played by this attachment may be transposed to a higher or lower key by a simple mechanical arrangement. This player was exhibited by the United States Patent Office at St. Louis in 1904 and at the Lewis and Clark Exposition at Portland in 1905.

The perforated music for automatic attachments and players, whether cabinet or interior, pneumatic or electric, is becoming standardized to a great extent and the same music generally may be used with any style of player. There are, however, music arrangements in two sizes, taking in a range of six and one-half to seven and one-third octaves. There is an expensive attachment which marks this music paper from the actual playing on a piano, but more accurate and satisfactory results are obtained by marking the music from the original score by hand, on a master roll which is proof read, tested, and corrected.

Expression marks are decided by interpretation experts and on important selections the composer's ideas are obtained wherever possible. The music is then cut automatically, 15 rolls at a time, from the perfect master roll and the expression and other marks are put on from a cardboard pattern. Extensive classification has been made of the many selections and arrangements in perforated music, and circulating libraries and educational departments in the principal cities have catalogues of roll music listed in grades.

PIANO AND ORGAN MATERIALS.

The value of piano and organ materials is shown separately for the first time at this census. These statistics do not include the total value of these products, for only those factories which manufacture parts and materials are included, the parts made by factories manufacturing the finished instrument being included with pianos and organs.

It is probably true that this first presentation of the subject may not include certain piano parts made by establishments primarily engaged in the manufacture of other products, and this fact should be taken into consideration in the examination of the figures. Certain foundry and machine shops may have cast piano plates or other piano hardware which are not specified separately from the other products of the establishment, or furniture manufacturers may have made cases or piano stock to some extent not specifically mentioned in their reports, and such partial products would not be included in the value reported for piano and organ parts and materials.

Table 14 is a summary for the United States and selected states showing the value of piano materials and parts, and all other products including organ materials and parts, and piano and organ materials and parts, not specified, and other products of a miscellaneous nature.

TABLE 14.—*Piano and organ materials—value of products, by states: 1905.*

STATE.	Total.	Piano materials and parts.	All other products, including organ materials and parts, and piano and organ materials and parts, not specified.
United States	[1] $13,128,315	$11,397,907	[2] $1,730,408
Connecticut	2,397,822	1,653,286	744,536
Illinois	998,239	655,911	342,328
Massachusetts	2,165,393	1,874,014	291,379
New Jersey	288,959	285,559	3,400
New York	5,226,947	5,142,812	84,135
Ohio	1,412,839	1,295,905	116,934
All other states [3]	638,116	490,420	147,696

[1] In addition, piano and organ materials and parts to a value of $572,686, unfinished pianos to a value of $179,547, and unfinished organs to a value of $152,621 were made by establishments engaged primarily in the manufacture of pianos and organs; and piano materials to a value of $281,016 were made by establishments engaged primarily in the manufacture of musical instruments and materials, not specified.

[2] Includes organ materials and parts to a value of $581,373, and piano and organ materials and parts, not specified, amounting to $647,612.

[3] Includes states as follows: California, Indiana, Michigan, New Hampshire, Pennsylvania, Vermont.

The product of establishments manufacturing piano and organ materials and parts in the United States is divided in the following proportions: Piano materials and parts, 86.9 per cent; organ materials and parts, 4.4 per cent; piano and organ materials and parts, not specified, 4.9 per cent; and all other products, 3.8 per cent. The principal item of this manufacture is th fore piano materials and parts. It is interesting to i that the value reported under this head is 26.2 per of the total value of pianos manufactured in the Un States during 1904. This indicates the tendency specialization in the manufacture of piano mate and parts.

As New York predominates in the piano industr is natural that this state should also lead in the ma facture of piano materials and parts. The chief ce is New York city, where piano materials and p were manufactured in 1904 to a value of $3,491, which amount is nearly one-third of the United St total for this class of products. This amount incl the product of two supply factories on Long Isl where piano parts are manufactured, and eventu transferred to another factory belonging to the s establishment, to be assembled. Tonawanda, Roc ter, Dolgeville, Castleton, Brockport, and St. Johns and other towns in New York also report a consider product of piano materials and parts. Massachus ranks second in this industry, the chief cities b Cambridge and Leominster. The third state in r is Connecticut, where Ivoryton reports the princ production, with Stamford second. In Ohio, fourth state in this industry, the localities of chief duction are Springfield and Cincinnati. Chicago, Lisbon, N. H., and Grand Rapids, Mich., are also portant centers.

Organ materials and parts are manufacture only a small extent separate from the finished ins ment. The principal localities for this production Worcester, Reading, and Westfield, in Massachus Chicago, in Illinois; Ivoryton, Mansfield, and I River, in Connecticut; and Alliance, in Ohio. At census of 1905 the total value of the product for United States amounted to but $581,373. The l item in Connecticut for all other products, inclu piano and organ materials, not specified, as show Table 14, is largely for piano and organ keyboard

Table 15 presents statistics concerning the valu specific piano materials and parts manufactured in United States, showing the per cent each item i the total reported for this class of products.

TABLE 15.—*Piano materials and parts—distribution of valu kind: 1905.*

KIND.	Value.	Pe of
Total	$11,397,907	
Actions and action parts	3,439,394	
Cases and piano stock	2,732,493	
Ivory and keys, including keyboards	2,048,795	
Plates, hardware, and strings	2,023,646	
Sounding boards and bridges	447,347	
Piano materials and parts, not specified, including partially manufactured pianos for which a separate division of parts is not obtainable	706,232	

The table shows that the manufacture of actions and action parts forms the most important branch of the production of piano materials and parts. New York state reports the manufacture of piano actions and action parts to a value of $2,160,614, which is 62.8 per cent of the total value reported for the entire United States. Of this amount New York city claims a value of $1,714,419, and a considerable product is also reported for Castleton, St. Johnsville, and Nassau, and other localities in New York state. Outside of New York state Cambridge, Mass., Ivoryton, Conn., and Chicago, Ill., are the chief centers for the manufacture of actions, and there are establishments also in Cincinnati, Ohio, Fort Lee, N. J., Rockford, Ill., and Boston, Mass.

Piano cases, frames, backs, and legs, including ribs, trusses, and trimmings, are manufactured to a value of $2,732,493, and of this amount $1,022,877 was for New York state, chiefly in New York city, Rochester, Brockport, Cortland, and Dolgeville, in the order named. Leominster, Arlington, and Westfield are the centers in Massachusetts, the second state in this manufacture.

The principal locality in the United States for the manufacture of piano ivory and keys, including keyboards, is Ivoryton, Conn., while Tonawanda, N. Y., and Cambridge, Mass., are respectively second and third.

Piano plates are manufactured very largely in Springfield, Ohio, New York, N. Y., Stamford, Conn., and are also reported in Chicago, Ill., as well as in a number of other cities in lesser values.

Sounding boards and bridges are reported chiefly by establishments located in Lisbon, N. H., and Dolgeville, N. Y., although several other localities reported considerable product.

Table 16 presents the kind and value of organ materials and parts manufactured by factories not reporting the finished instrument.

TABLE 16.—*Organ materials and parts—distribution of value, by kind: 1905.*

KIND.	Value.	Per cent of total.
Total	$581,373	100.0
Pipes, reeds, and reed boards	366,137	63.0
Ivory and keys, including stops, knobs, couplers, tremolos, etc.	185,680	31.9
Organ materials and parts not specified	29,556	5.1

The principal organ parts which are reported as manufactured separate from the finished instrument are pipes, reeds, and reed boards. Chicago reported the principal manufacture of reeds and reed boards, with Worcester, Mass., second, while Reading, Mass., reported organ pipes to a considerable extent.

Tables 17, 18, 19, and 20, which follow, present detailed statistics, by states, for each of the four industries embraced in the group of musical instruments, attachments, and materials.

TABLE 17.—MUSICAL INSTRUMENTS, PIANOS—

		United States.	California.	Connecticut.	Illinois.
1	Number of establishments	249	[illegible]	8	36
2	Capital, total	$49,649,135	$65,770	$3,049,225	$14,908,172
3	Land	$3,083,605	$8,000	$51,702	$766,209
4	Buildings	$5,375,990	$4,800	$386,617	$1,820,096
5	Machinery, tools, and implements	$3,032,643	$4,852	$189,029	$712,443
6	Cash and sundries	$38,156,897	$48,118	$2,421,877	$11,609,424
7	Proprietors and firm members	137	4	....	9
	Salaried officials, clerks, etc.:				
8	Total number	2,068	3	68	645
9	Total salaries	$2,846,685	$2,675	$121,722	$761,417
	Officers of corporations—				
10	Number	297	1	15	67
11	Salaries	$1,020,923	$375	$47,605	$213,543
	General superintendents, managers, clerks, etc.—				
12	Total number	1,771	2	53	578
13	Total salaries	$1,825,762	$2,300	$74,117	$547,874
	Men—				
14	Number	1,498	2	43	492
15	Salaries	$1,690,475	$2,300	$69,317	$502,982
	Women—				
16	Number	273	....	10	86
17	Salaries	$135,287	....	$4,800	$44,892
	Wage-earners, including pieceworkers, and total wages:				
18	Greatest number employed at any one time during the year	24,249	28	1,347	6,913
19	Least number employed at any one time during the year	18,018	21	950	5,654
20	Average number	21,002	17	1,169	6,268
21	Total wages	$12,170,251	$14,669	$648,684	$3,279,418
	Men 16 years and over—				
22	Average number	20,253	17	1,057	5,944
23	Wages	$11,956,149	$14,669	$610,928	$3,200,770
	Women 16 years and over—				
24	Average number	469	....	90	136
25	Wages	$156,912	....	$31,589	$40,564
	Children under 16 years—				
26	Average number	280	....	22	188
27	Wages	$57,190	....	$6,167	$38,084
	Average number of wage-earners, including pieceworkers, employed during each month:				
	Men 16 years and over—				
28	January	19,591	14	1,025	5,554
29	February	19,732	13	1,092	5,677
30	March	20,000	14	1,094	5,761
31	April	20,067	16	1,098	5,837
32	May	19,980	12	1,122	5,767
33	June	19,860	12	1,112	5,867
34	July	19,107	14	940	5,865
35	August	19,542	15	1,052	5,933
36	September	20,431	16	1,053	6,125
37	October	21,221	27	1,032	6,241
38	November	21,700	26	1,034	6,321
39	December	21,805	25	1,030	6,380
	Women 16 years and over—				
40	January	457	....	70	128
41	February	491	....	89	132
42	March	507	....	103	132
43	April	514	....	105	134
44	May	504	....	106	133
45	June	489	....	104	127
46	July	410	....	80	128
47	August	421	....	82	144
48	September	437	....	87	141
49	October	449	....	85	145
50	November	465	....	84	140
51	December	484	....	85	148
	Children under 16 years—				
52	January	259	....	20	178
53	February	268	....	21	186
54	March	270	....	33	174
55	April	286	....	32	190
56	May	284	....	32	189
57	June	285	....	31	190
58	July	269	....	15	181
59	August	293	....	16	198
60	September	285	....	16	188
61	October	285	....	16	191
62	November	288	....	16	195
63	December	288	....	16	196
64	Miscellaneous expenses, total	$5,532,420	$4,266	$241,480	$1,464,899
65	Rent of works	$469,576	$1,680	$15,493	$55,534
66	Taxes	$192,692	$265	$9,473	$58,747
67	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$4,575,963	$1,971	$216,514	$1,278,695
68	Contract work	$294,189	$350	....	$71,923
69	Materials used, total cost	$19,587,770	$16,016	$976,515	$4,503,165
70	Principal materials	$16,868,593	$11,971	$709,[illegible]	$3,722,348
71	Fuel	$304,217	$175	$29,308	$92,306
72	Rent of power and heat	$41,896	$229	$1,170	$8,799
73	Mill supplies	$63,524	$5	$2,849	$26,428
74	All other materials	$2,226,667	$3,316	$225,618	$631,405
75	Freight	$82,873	$320	$7,695	$21,879

[1] Includes establishments distributed as follows: Colorado, 1; Kentucky, 3; Louisiana, 1; Maine, 1; Maryland, 4; Minnesota, 3; Missouri, 2; Nebraska, 1; New Hampshire, 2; West Virginia, 1; Wisconsin, 1.

DETAILED SUMMARY, BY STATES: 1905.

Indiana.	Massachusetts.	Michigan.	New Jersey.	New York.	Ohio.	Pennsylvania.	All other states.[1]	
8	21	7	8	104	14	17	20	1
$2,519,979	$5,749,266	$1,190,809	$1,368,220	$15,504,312	$1,631,907	$1,498,346	$2,163,129	2
$31,526	$518,565	$34,770	$74,000	$1,361,975	$71,908	$62,646	$102,304	3
$418,490	$432,667	$133,186	$177,380	$1,380,229	$198,049	$201,104	$223,372	4
$287,618	$350,954	$46,768	$347,661	$713,984	$184,838	$60,892	$133,604	5
$1,782,345	$4,447,080	$976,085	$769,179	$12,048,124	$1,177,112	$1,173,704	$1,703,849	6
1	7	5	4	79	2	11	15	7
175	210	31	53	671	66	55	91	8
$182,021	$308,025	$52,500	$65,011	$1,030,747	$94,777	$76,455	$151,335	9
20	36	5	3	111	21	7	11	10
$53,440	$156,978	$21,000	$12,700	$409,138	$49,384	$16,600	$40,160	11
155	174	26	50	500	45	48	80	12
$128,581	$151,047	$31,500	$52,311	$621,609	$45,393	$59,855	$111,175	13
125	134	19	43	498	34	38	70	14
$115,229	$132,323	$28,180	$47,814	$587,795	$41,593	$56,491	$106,451	15
30	40	7	7	82	11	10	10	16
$13,352	$18,724	$3,320	$4,497	$33,814	$3,800	$3,364	$4,724	17
1,407	2,403	504	933	8,044	934	791	945	18
938	1,794	454	619	5,433	784	593	778	19
1,196	2,156	487	821	6,466	845	703	874	20
$614,673	$1,374,562	$251,968	$455,373	$4,188,926	$473,511	$367,937	$500,530	21
1,150	2,114	482	742	6,389	831	675	852	22
$599,673	$1,359,368	$250,468	$425,733	$4,166,617	$469,121	$361,560	$497,242	23
46	39	5	73	65	9	4	2	24
$15,000	$14,635	$1,500	$28,600	$20,315	$3,365	$864	$480	25
...	3	...	6	12	5	24	20	26
...	$559	...	$1,040	$1,994	$1,025	$5,513	$2,808	27
1,073	2,099	476	769	6,246	814	662	859	28
1,086	2,063	481	768	6,221	807	668	856	29
1,095	2,122	475	765	6,338	792	687	857	30
1,079	2,071	474	772	6,353	806	691	870	31
1,088	2,109	476	769	6,240	826	720	851	32
1,084	2,074	475	761	6,155	829	685	806	33
1,103	2,027	483	602	5,809	802	683	779	34
1,052	1,960	479	696	6,015	822	677	841	35
1,195	2,117	486	693	6,354	850	680	862	36
1,274	2,233	491	717	6,823	863	641	879	37
1,340	2,258	489	784	7,050	871	643	884	38
1,331	2,235	499	808	7,064	890	663	880	39
51	45	5	82	62	8	4	2	40
51	40	5	93	66	9	4	2	41
46	41	5	100	66	8	4	2	42
47	41	5	102	66	8	4	2	43
45	41	5	94	66	8	4	2	44
43	41	5	89	65	9	4	2	45
40	34	5	46	64	7	4	2	46
41	24	5	46	64	9	4	2	47
43	37	5	44	64	10	4	2	48
47	39	5	46	65	11	4	2	49
48	43	5	62	66	11	4	2	50
50	42	5	72	66	10	4	2	51
...	2	...	7	13	4	19	16	52
...	2	...	6	12	4	19	18	53
...	3	...	6	12	4	19	19	54
...	3	...	5	13	4	19	20	55
...	3	...	5	12	5	20	18	56
...	3	...	6	12	5	20	18	57
...	3	...	6	12	5	30	17	58
...	3	...	6	12	5	29	24	59
...	3	...	6	12	6	20	25	60
...	3	...	7	12	6	28	22	61
...	4	...	6	11	6	28	22	62
...	4	...	6	11	6	28	21	63
$201,759	$611,104	$96,735	$60,925	$2,122,342	$260,461	$143,476	$324,973	64
$480	$58,696	...	$16,037	$285,994	$21,193	$7,551	$6,918	65
$7,996	$35,480	$8,369	$5,213	$48,565	$7,119	$2,048	$9,417	66
$156,783	$454,247	$88,366	$39,675	$1,666,959	$230,238	$133,877	$308,638	67
$36,500	$62,681	...	...	$120,824	$1,911	...	...	68
$861,763	$1,851,940	$381,320	$535,920	$8,461,342	$988,814	$479,409	$531,566	69
$789,450	$1,536,167	$310,015	$501,835	$7,488,004	$881,743	$421,251	$495,934	70
$32,814	$38,614	$6,107	$4,852	$62,192	$14,198	$12,296	$11,355	71
...	$1,210	$360	$11,647	$14,706	$1,415	$160	$2,200	72
$4,985	$4,020	$4,525	$3,019	$12,985	$2,210	$1,258	$1,240	73
$34,439	$260,725	$57,584	$11,050	$864,577	$84,726	$37,713	$15,514	74
$75	$11,204	$2,729	$3,517	$18,878	$4,522	$6,731	$5,323	75

TABLE 17.—MUSICAL INSTRUMENTS, PIANOS—

		United States.	California	Connecticut.	Illinois.
76	Value of products, including amount received for custom work and repairing	$46,922,471	$44,146	$2,684,973	$11,332,507
	Power:				
77	Number of establishments reporting	176	2	8	32
78	Total horsepower	19,280	13	1,043	5,764
	Owned—				
	Engines—				
	Steam—				
79	Number	154		11	28
80	Horsepower	15,906		845	4,590
	Gas and gasoline—				
81	Number	11			
82	Horsepower	216			
	Water wheels—				
83	Number	8		2	1
84	Horsepower	279		50	75
	Water motors—				
85	Number	3			
86	Horsepower	21			
	Electric motors—				
87	Number	140		11	48
88	Horsepower	1,813		100	694
	Rented—				
	Electric motors—				
89	Number	106	2	8	24
90	Horsepower	764	13	48	287
91	Other kind, horsepower	281			118
92	Furnished to other establishments, horsepower	70			10

DETAILED SUMMARY, BY STATES: 1905—Continued.

Indiana.	Massachusetts.	Michigan.	New Jersey.	New York.	Ohio.	Pennsylvania.	All other states.	
$2,216,804	$5,312,244	$1,016,824	$1,188,051	$17,954,219	$965,097	$1,303,029	$1,904,577	76
6	17	6	4	64	13	14	10	77
2,332	1,825	517	1,308	3,871	968	509	1,130	78
11	15	5	6	50	8	11	9	79
2,135	1,470	515	985	3,335	810	420	801	80
1	...	...	...	6	1	2	1	81
87	...	...	...	68	25	28	8	82
...	1	...	...	3	...	1	...	83
...	34	...	...	105	...	15	...	84
...	2	...	...	...	...	...	1	85
...	13	...	...	...	...	...	8	86
5	36	...	18	1	...	2	19	87
100	275	...	321	3	...	27	293	88
...	6	2	1	29	25	5	4	89
...	23	2	2	225	133	19	12	90
10	10	...	...	135	...	...	8	91
...	...	...	20	40	...	...	...	92

TABLE 18.—MUSICAL INSTRUMENTS, ORGANS—DETAILED SUMMARY, BY STATES: 1905.

	United States.	Connecticut.	Illinois.	Indiana.	Massachusetts.	Michigan.	New York.	Ohio.	Pennsylvania.	All other states.[1]
Number of establishments	94	3	13	4	10	3	14	7	11	29
Capital, total	$7,203,878	$157,292	$1,026,052	$97,311	$823,737	$1,025,429	$178,788	$317,232	$788,012	$2,790,025
Land	$293,428	$15,500	$44,250	$16,500	$18,700	$14,519	$18,600	$14,800	$50,100	$100,459
Buildings	$758,104	$28,700	$134,434	$26,500	$53,233	$79,242	$28,400	$36,351	$88,606	$282,638
Machinery, tools, and implements	$663,852	$18,156	$98,799	$21,668	$79,823	$94,463	$27,230	$17,255	$37,882	$268,576
Cash and sundries	$5,488,494	$94,936	$748,569	$32,643	$671,981	$837,205	$104,558	$248,826	$611,424	$2,138,352
Proprietors and firm members	87	4	7	2	6	4	17	6	9	32
Salaried officials, clerks, etc.:										
Total number	323	14	53	5	42	51	7	19	27	105
Total salaries	$372,362	$13,801	$69,512	$5,300	$56,223	$57,051	$8,730	$17,360	$27,178	$117,207
Officers of corporations—										
Number	51	2	15	1	9	5	....	4	5	10
Salaries	$119,996	$3,600	$31,900	$2,600	$22,460	$15,400	....	$3,744	$12,967	$27,325
General superintendents, managers, clerks, etc.—										
Total number	272	12	38	4	33	46	7	15	22	95
Total salaries	$252,366	$10,201	$37,612	$2,700	$33,763	$41,651	$8,730	$13,616	$14,211	$89,882
Men—										
Number	206	7	27	3	22	43	7	9	17	71
Salaries	$218,538	$6,586	$30,928	$2,400	$26,944	$40,599	$8,730	$10,786	$12,168	$79,397
Women—										
Number	66	5	11	1	11	3	....	6	5	24
Salaries	$33,828	$3,615	$6,684	$300	$6,819	$1,052	....	$2,830	$2,043	$10,485
Wage-earners, including pieceworkers, and total wages:										
Greatest number employed at any one time during the year	4,111	115	570	56	683	519	137	231	343	1,457
Least number employed at any one time during the year	3,112	94	474	29	484	279	88	179	262	1,223
Average number	3,623	106	508	41	552	462	102	205	305	1,342
Total wages	$2,034,559	$67,067	$314,230	$15,132	$365,194	$229,659	$71,437	$108,975	$157,423	$705,442
Men 16 years and over—										
Average number	3,503	100	490	41	529	435	100	188	300	1,311
Wages	$1,993,647	$64,753	$311,714	$15,132	$356,768	$220,531	$70,937	$103,663	$156,663	$693,486
Women 16 years and over—										
Average number	108	5	6	....	21	27	2	17	2	28
Wages	$38,998	$2,106	$2,016	....	$8,114	$9,128	$500	$5,312	$378	$11,444
Children under 16 years—										
Average number	12	1	3	....	2	....	....	....	3	3
Wages	$1,914	$208	$500	....	$312	....	....	....	$382	$512
Average number of wage-earners, including pieceworkers, employed during each month:										
Men 16 years and over—										
January	3,532	100	511	53	582	386	114	201	313	1,272
February	3,524	99	522	49	507	446	100	202	308	1,291
March	3,472	101	486	45	500	457	95	203	314	1,271
April	3,505	103	484	43	495	458	99	203	319	1,301
May	3,452	106	485	43	461	448	94	202	314	1,299
June	3,412	106	492	43	415	471	93	186	303	1,303
July	3,439	107	496	40	508	434	101	182	277	1,294
August	3,507	99	497	41	564	428	106	189	279	1,304
September	3,517	98	497	37	583	430	108	152	285	1,327
October	3,535	95	503	31	579	433	100	156	291	1,347
November	3,569	94	508	32	579	429	94	188	296	1,349
December	3,572	92	507	35	575	400	96	192	301	1,374
Women 16 years and over—										
January	103	6	6	....	20	21	2	18	2	28
February	108	4	6	....	21	27	2	18	2	28
March	110	4	6	....	20	30	2	18	2	28
April	106	4	6	....	20	27	2	17	2	28
May	104	5	6	....	21	23	2	16	2	29
June	107	5	6	....	20	28	2	15	2	29
July	104	5	6	....	22	27	2	15	2	25
August	110	6	6	....	21	29	2	16	2	28
September	112	5	6	....	22	29	2	17	2	29
October	113	5	6	....	22	30	2	18	2	28
November	113	6	6	....	22	29	2	18	2	28
December	106	5	6	....	21	24	2	18	2	28
Children under 16 years—										
January	9	1	1	....	2	....	....	....	2	3
February	9	1	1	....	2	....	....	....	2	3
March	12	1	2	....	3	....	....	....	3	3
April	12	1	2	....	3	....	....	....	3	3
May	12	1	3	....	2	....	....	....	3	3
June	12	1	3	....	2	....	....	....	3	3
July	14	1	4	....	2	....	....	....	3	3
August	14	1	4	....	2	....	....	....	4	3
September	12	1	4	....	1	....	....	....	4	3
October	13	1	4	....	2	....	....	....	3	3
November	12	1	4	....	1	....	....	....	3	3
December	13	1	4	....	2	....	....	....	3	3
Miscellaneous expenses, total	$818,276	$28,597	$65,515	$7,274	$130,153	$200,102	$20,974	$23,062	$37,585	$305,014
Rent of works	$54,524	$1,640	$4,007	$72	$22,266	$4,700	$6,233	$750	$1,522	$13,334
Taxes	$20,815	$534	$2,787	$266	$3,172	$5,576	$734	$626	$1,264	$5,856
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$724,899	$26,423	$57,258	$3,336	$104,215	$189,826	$13,787	$20,186	$29,924	$279,944
Contract work	$18,038	....	$1,463	$3,600	$500	....	$220	$1,500	$4,875	$5,880
Materials used, total cost	$2,068,638	$54,945	$368,115	$21,797	$218,723	$310,455	$63,818	$104,070	$166,288	$760,427
Principal materials	$1,544,558	$33,899	$281,103	$19,024	$169,916	$211,431	$49,954	$39,168	$135,652	$604,411
Fuel	$66,784	$1,739	$12,456	$1,675	$8,614	$7,798	$1,179	$1,420	$5,875	$26,028
Rent of power and heat	$9,970	$600	$4,435	$50	$516	....	$1,224	$480	....	$2,665
Mill supplies	$10,997	$228	$1,761	$45	$1,045	$180	$334	$369	$1,496	$5,539
All other materials	$405,497	$16,379	$65,561	$450	$38,327	$79,244	$9,697	$61,119	$22,034	$112,686
Freight	$30,832	$2,100	$2,799	$553	$305	$11,802	$1,430	$1,514	$1,231	$9,098

[1] Includes establishments distributed as follows: California, 4; Delaware, 1; Iowa, 1; Kansas, 2; Kentucky, 3; Maine, 1; Maryland, 4; Minnesota, 2; Missouri, 2; New Jersey, 3; Rhode Island, 1; Vermont, 2; Virginia, 1; Wisconsin, 2.

TABLE 18.—MUSICAL INSTRUMENTS, ORGANS—DETAILED SUMMARY, BY STATES: 1905—Continued.

	United States.	Connecticut.	Illinois.	Indiana.	Massachusetts.	Michigan.	New York.	Ohio.	Pennsylvania.	All other states.
Value of products, including amount received for custom work and repairing	$6,041,844	$190,040	$992,612	$53,191	$800,991	$824,777	$208,338	$306,270	$453,513	$2,212,112
Power:										
Number of establishments reporting	73	3	12	3	10	3	7	6	7	22
Total horsepower	4,454	100	998	114	403	518	94	154	399	1,674
Owned—										
Engines—										
Steam—										
Number	40	1	5	3	5	5		2	5	14
Horsepower	3,145	50	335	110	295	500		60	365	1,430
Gas and gasoline—										
Number	18	1	1		2		3	4	2	5
Horsepower	266	12	10		20		38	77	20	89
Water wheels—										
Number	3		1		2					
Horsepower	235		200		35					
Water motors—										
Number	2				1				1	
Horsepower	11				1				10	
Electric motors—										
Number	44		3		15	9			1	16
Horsepower	369		202		37	18			4	108
Other power, horsepower	6		6							
Rented—										
Electric motors—										
Number	35	6	12	1			5	2		9
Horsepower	200	13	83	4			36	17		47
Other kind, horsepower	222	25	162		15		20			
Furnished to other establishments, horsepower	12				12					

Table 19.—MUSICAL INSTRUMENTS, PIANO AND ORGAN MATERIALS—DETAILED SUMMARY, BY STATES: 1905.

	United States.	Connecticut.	Illinois.	Massachusetts.	Michigan.	New Jersey.	New York.	Ohio.	All other states.[1]
Number of establishments	101	6	7	24	3	6	42	5	8
Capital, total	$11,628,897	$2,019,779	$536,456	$1,733,215	$147,846	$153,897	$5,339,886	$1,407,418	$290,400
Land	$1,159,848	$83,900	$59,335	$120,050	$7,191	$5,500	$794,689	$75,923	$13,260
Buildings	$1,858,768	$193,147	$58,301	$280,510	$57,000	$31,302	$1,033,046	$155,000	$50,462
Machinery, tools, and implements	$1,766,829	$196,656	$120,936	$236,647	$32,036	$43,705	$835,622	$243,262	$57,965
Cash and sundries	$6,843,452	$1,546,076	$297,884	$1,096,008	$51,619	$73,390	$2,676,529	$933,233	$168,713
Proprietors and firm members	79	2	2	24	5	2	37	2	5
Salaried officials, clerks, etc.:									
Total number	331	44	41	40	2	12	148	31	13
Total salaries	$508,883	$104,303	$55,094	$64,301	$3,600	$12,115	$216,846	$38,264	$14,360
Officers of corporations—									
Number	80	12	8	14	...	6	30	5	5
Salaries	$215,521	$59,300	$11,636	$33,360	...	$5,730	$86,315	$11,900	$7,280
General superintendents, managers, clerks, etc.—									
Total number	251	32	33	26	2	6	118	26	8
Total salaries	$293,362	$45,003	$43,458	$30,941	$3,600	$6,385	$130,531	$26,364	$7,080
Men—									
Number	224	28	31	22	2	5	105	24	7
Salaries	$279,060	$42,283	$41,980	$29,047	$3,600	$6,350	$123,297	$25,523	$6,980
Women—									
Number	27	4	2	4	...	1	13	2	1
Salaries	$14,302	$2,720	$1,478	$1,894	...	$35	$7,234	$841	$100
Wage-earners, including pieceworkers, and total wages:									
Greatest number employed at any one time during the year	9,368	1,452	829	1,571	129	349	3,303	1,336	399
Least number employed at any one time during the year	7,280	1,062	662	1,374	98	251	2,666	888	279
Average number	8,456	1,308	732	1,463	120	289	3,046	1,160	338
Total wages	$4,322,268	$621,003	$338,021	$748,501	$54,910	$104,798	$1,664,577	$622,550	$167,908
Men 16 years and over—									
Average number	7,566	1,152	594	1,198	120	252	2,759	1,154	337
Wages	$4,075,807	$575,366	$300,789	$668,782	$54,910	$90,754	$1,596,613	$621,387	$167,206
Women 16 years and over—									
Average number	656	151	138	224	...	15	121	6	1
Wages	$197,925	$44,188	$37,232	$71,920	...	$5,835	$36,885	$1,163	$702
Children under 16 years—									
Average number	234	5	...	41	...	22	166	...	...
Wages	$48,536	$1,449	...	$7,799	...	$8,209	$31,079	...	...
Average number of wage-earners, including pieceworkers, employed during each month:									
Men 16 years and over—									
January	7,572	1,237	634	1,198	126	290	2,771	941	375
February	7,743	1,171	619	1,187	126	285	2,775	1,211	369
March	7,598	1,112	626	1,199	126	262	2,705	1,195	373
April	7,516	1,088	597	1,211	127	244	2,729	1,175	345
May	7,379	1,061	571	1,194	127	247	2,704	1,142	333
June	7,271	1,077	559	1,159	129	240	2,672	1,117	318
July	7,282	1,155	561	1,162	126	222	2,689	1,057	310
August	7,402	1,184	560	1,192	126	231	2,684	1,104	321
September	7,548	1,182	585	1,194	114	239	2,750	1,148	336
October	7,772	1,184	605	1,232	114	238	2,840	1,226	333
November	7,792	1,193	605	1,216	100	251	2,848	1,258	321
December	7,917	1,180	606	1,232	99	275	2,941	1,274	310
Women 16 years and over—									
January	705	166	165	238	...	15	120	...	1
February	662	140	158	228	...	15	120	...	1
March	647	133	155	221	...	15	122	...	1
April	625	131	141	224	...	14	114	...	1
May	612	129	135	212	...	15	115	5	1
June	600	122	120	214	...	15	123	5	1
July	650	176	119	210	...	14	125	5	1
August	651	173	120	219	...	15	116	7	1
September	611	126	125	216	...	15	121	7	1
October	681	174	125	233	...	15	123	10	1
November	711	172	143	237	...	16	126	16	1
December	717	170	150	236	...	16	127	17	1
Children under 16 years—									
January	226	4	...	37	...	27	158	...	...
February	236	4	...	39	...	27	166	...	...
March	234	4	...	41	...	25	164	...	...
April	237	6	...	40	...	24	167	...	...
May	239	6	...	44	...	20	169	...	...
June	222	6	...	43	...	20	153	...	...
July	223	5	...	41	...	20	157	...	...
August	228	5	...	40	...	20	163	...	...
September	241	5	...	41	...	20	175	...	...
October	230	5	...	35	...	20	171	...	...
November	251	5	...	45	...	19	180	...	...
December	241	5	...	46	...	21	169	...	...
Miscellaneous expenses, total	$787,475	$159,363	$37,686	$138,429	$9,683	$21,230	$267,241	$112,096	$41,747
Rent of works	$79,623	...	$2,969	$11,165	$1,020	$5,568	$44,008	$13,153	$1,740
Taxes	$58,200	$8,369	$2,558	$10,272	$610	$594	$24,856	$8,329	$2,612
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$620,999	$145,249	$31,992	$116,992	$8,053	$15,068	$181,001	$90,614	$32,030
Contract work	$28,653	$5,745	$167	...	...	...	$17,376	...	$5,365
Materials used, aggregate cost	$6,330,219	$1,370,263	$526,457	$1,043,283	$58,665	$121,346	$2,425,135	$532,335	$252,735
Principal materials, total cost	$5,601,467	$1,226,385	$400,077	$951,002	$50,419	$106,976	$2,158,794	$485,069	$222,745
Purchased in raw state	$949,053	$710,482	...	...	...	...	$238,571	...	...
Purchased in partially manufactured form	$4,652,414	$515,903	$400,077	$951,002	$50,419	$106,976	$1,920,223	$485,069	$222,745
Fuel	$142,030	$36,383	$15,803	$18,000	$3,565	$10,106	$38,648	$17,639	$1,886
Rent of power and heat	$38,276	...	$1,250	$3,190	...	$300	$22,810	$8,920	$1,806
Mill supplies	$15,664	$2,092	$1,044	$2,258	$481	$663	$7,542	$1,040	$544
All other materials	$464,691	$89,433	$105,820	$60,321	$600	$3,111	$182,592	$13,667	$9,147
Freight	$68,091	$15,970	$2,463	$8,512	$3,600	$190	$14,749	$6,000	$16,607

[1] Includes establishments distributed as follows: California, 2; Indiana, 2; New Hampshire, 2; Pennsylvania, 1; Vermont, 1.

TABLE 19.—MUSICAL INSTRUMENTS, PIANO AND ORGAN MATERIALS—DETAILED SUMMARY, BY STATES: 1905—Continued.

	United States.	Connecticut.	Illinois.	Massachusetts.	Michigan.	New Jersey.	New York.	Ohio.	All other states.
Value of products, including amount received for custom work and repairing	$13,128,315	$2,397,822	$998,239	$2,165,393	$142,626	$288,959	$5,226,947	$1,412,839	$495,490
Power:									
Number of establishments reporting	86	6	6	21	3	6	34	4	6
Total horsepower	9,553	1,441	1,443	1,500	293	413	2,637	1,171	655
Owned—									
Engines—									
Steam—									
Number	69	16	5	11	3	7	21	2	4
Horsepower	6,649	1,028	720	1,276	285	405	2,065	375	495
Gas and gasoline—									
Number	8	....	....	1	....	....	3	3	1
Horsepower	259	....	....	10	....	....	34	210	5
Water wheels—									
Number	11	5	1	2	....	....	2	....	1
Horsepower	288	130	40	47	....	....	41	....	30
Water motors—									
Number	2	1	....	1	....	....	....	....	....
Horsepower	33	23	....	10	....	....	....	....	....
Electric motors—									
Number	48	15	20	5	....	....	2	4	1
Horsepower	971	260	500	35	....	....	30	140	6
Rented—									
Electric motors—									
Number	69	....	8	2	....	....	17	31	11
Horsepower	968	....	158	6	....	....	239	446	119
Other kind, horsepower	385	....	25	116	8	8	228	....	....
Furnished to other establishments, horsepower	113	....	10	70	....	2	31	....	....

TABLE 20.—MUSICAL INSTRUMENTS AND MATERIALS,

		United States.	California.	Connecticut.	Illinois.	Indiana.
1	Number of establishments	181	3	3	28	5
2	Capital, total	$3,743,469	$9,010	$4,700	$640,549	$445,374
3	Land	$97,402	$3,000	$50	$16,250	$13,800
4	Buildings	$318,408	$1,500	$250	$43,700	$44,550
5	Machinery, tools, and implements	$693,193	$470	$1,500	$129,969	$58,609
6	Cash and sundries	$2,634,466	$4,040	$2,900	$450,630	$328,415
7	Proprietors and firm members	190	4	3	27	3
	Salaried officials, clerks, etc.:					
8	Total number	225		1	41	39
9	Total salaries	$251,766		$1,000	$51,499	$42,790
	Officers of corporations—					
10	Number	43			11	3
11	Salaries	$73,807			$18,529	$1,248
	General superintendents, managers, clerks, etc.—					
12	Total number	182		1	30	36
13	Total salaries	$177,959		$1,000	$32,970	$41,542
	Men—					
14	Number	128		1	28	14
15	Salaries	$156,167		$1,000	$31,930	$33,050
	Women—					
16	Number	54			2	22
17	Salaries	$21,792			$1,040	$8,492
	Wage-earners, including pieceworkers, and total wages:					
18	Greatest number employed at any one time during the year	2,593	5	3	596	328
19	Least number employed at any one time during the year	1,584	4	2	171	290
20	Average number	2,139	5	2	491	283
21	Total wages	$1,162,068	$2,850	$1,396	$301,604	$125,047
	Men 16 years and over—					
22	Average number	1,890	5	2	472	252
23	Wages	$1,089,944	$2,850	$1,396	$297,404	$115,710
	Women 16 years and over—					
24	Average number	191			4	31
25	Wages	$60,612			$1,314	$9,337
	Children under 16 years—					
26	Average number	58			15	
27	Wages	$11,512			$2,886	
	Average number of wage-earners, including pieceworkers, employed during each month:					
	Men 16 years and over—					
28	January	1,937	5	1	487	220
29	February	1,946	5	1	494	225
30	March	1,933	5	1	508	225
31	April	1,686	5	1	263	235
32	May	1,783	5	1	420	247
33	June	1,792	5	1	489	251
34	July	1,800	5	3	480	258
35	August	1,816	5	3	443	261
36	September	1,958	5	3	516	279
37	October	1,971	5	3	489	271
38	November	2,023	5	3	525	275
39	December	2,035	5	3	550	277
	Women 16 years and over—					
40	January	184			4	27
41	February	185			4	28
42	March	186			4	30
43	April	186			4	28
44	May	186			4	29
45	June	189			4	31
46	July	188			4	31
47	August	188			4	29
48	September	196			4	33
49	October	199			4	34
50	November	204			4	36
51	December	201			4	36
	Children under 16 years—					
52	January	51			17	
53	February	60			17	
54	March	61			19	
55	April	56			14	
56	May	55			15	
57	June	55			15	
58	July	54			13	
59	August	56			13	
60	September	63			16	
61	October	61			14	
62	November	63			15	
63	December	61			12	
64	Miscellaneous expenses, total	$426,823	$689	$266	$56,634	$85,795
65	Rent of works	$74,903	$354	$146	$20,289	$420
66	Taxes	$12,554	$77	$5	$2,874	$2,170
67	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$338,324	$258	$115	$33,356	$83,110
68	Contract work	$1,042			$115	$05
69	Materials used, aggregate cost	$1,129,939	$2,170	$1,825	$206,948	$87,656
70	Principal materials, total cost	$795,116	$1,499	$1,764	$185,688	$68,922
71	Purchased in raw state	$8,405			$2,000	$640
72	Purchased in partially manufactured form	$786,711	$1,499	$1,764	$183,688	$68,282
73	Fuel	$22,801		$21	$6,069	$3,787
74	Rent of power and heat	$18,907		$40	$2,929	$180
75	Mill supplies	$8,019			$857	$1,923
76	All other materials	$275,309	$621		$9,276	$12,830
77	Freight	$9,787	$50		$2,129	$14

[1] Includes establishments distributed as follows: Colorado, 2; Georgia, 1; Iowa, 2; Kentucky, 1; Louisiana, 1; Nebraska, 1; Oregon, 1.

NOT SPECIFIED—DETAILED SUMMARY, BY STATES: 1905.

Maryland.	Massachusetts.	Michigan.	Minnesota.	Missouri.	New Jersey.	New York.	Ohio.	Pennsylvania.	Washington.	Wisconsin.	All other states.[1]	
3	22	7	4	5	7	56	7	16	3	3	9	1
$9,375	$143,280	$77,794	$5,100	$23,334	$892,134	$1,224,538	$44.861	$180,783	$1,450	$5,430	$35,757	2
	$928	$3,100		$3,875	$29,234	$13,065		$8,500		$500	$5,100	3
	$3,075	$6,435		$8,575	$144,819	$25,800	$75	$23,200		$270	$16,159	4
$2,050	$40,712	$12,224	$1,750	$3,584	$148,459	$231,997	$16,248	$35,031	$600	$3,100	$6,890	5
$7,325	$98,565	$56,035	$3,350	$7,300	$569,622	$953,676	$28,538	$114,052	$850	$1,560	$7,608	6
4	21	9	4	3	7	62	4	23	3	3	10	7
	7	14	1	2	55	49	4	10			2	8
	$9,696	$10,432	$250	$1,050	$62,330	$60,559	$3,911	$7,609			$640	9
	5	2			6	13	2	1				10
	$8,500	$2,400			$13,000	$25,230	$2,400	$2,500				11
	2	12	1	2	49	36	2	9			2	12
	$1,196	$8,032	$250	$1,050	$49,330	$35,329	$1,511	$5,109			$640	13
		7	1	1	39	30	1	5			1	14
		$6,294	$250	$900	$45,246	$32,637	$1,140	$3,600			$120	15
	2	5		1	10	6	1	4			1	16
	$1,196	$1,738		$150	$4,084	$2,692	$371	$1,509			$520	17
3	157	135	8	27	623	545	21	131	1	2	8	18
2	120	76	1	24	382	380	16	107	1	2	6	19
2	136	109	4	25	465	468	19	120	1	2	7	20
$1,320	$77,512	$49,075	$2,300	$14,338	$251,385	$250,908	$10,659	$65,206	$1,000	$1,440	$6,028	21
2	120	105	4	25	327	432	17	117	1	2	7	22
$1,320	$72,711	$47,975	$2,300	$14,338	$211,827	$238,636	$10,295	$64,714	$1,000	$1,440	$6,028	23
	15	4			109	26	2					24
	$4,593	$1,100			$34,168	$9,736	$364					25
	1				29	10		3				26
	$208				$5,390	$2,536		$492				27
2	129	106	7	23	378	434	18	117	1	2	7	28
2	129	102	6	24	375	438	18	117	1	2	7	29
2	124	106	6	25	341	445	18	117	1	2	7	30
2	115	102	4	25	355	435	17	117	1	2	7	31
2	112	104	1	25	297	425	17	117	1	2	7	32
2	112	95	1	25	241	426	17	117	1	2	7	33
2	113	83	1	25	278	409	17	117	1	2	6	34
2	114	89	1	25	313	417	16	117	1	2	7	35
2	113	102	2	25	335	432	17	117	1	2	7	36
2	122	127	4	26	341	435	18	118	1	2	7	37
2	130	123	7	26	343	443	15	116	1	2	7	38
2	127	121	8	26	327	445	16	117	1	2	8	39
	17	4			109	21	2					40
	17	4			108	22	2					41
	15	4			109	22	2					42
	14	4			110	24	2					43
	13	4			109	25	2					44
	13	4			110	25	2					45
	13	4			108	26	2					46
	13	4			109	27	2					47
	13	4			110	30	2					48
	16	4			109	30	2					49
	18	4			110	30	2					50
	18	4			107	30	2					51
	1				20	10		3				52
	1				27	10		5				53
	1				28	10		3				54
	1				29	10		2				55
	1				29	8		2				56
	1				28	8		3				57
	1				27	10		3				58
	1				29	10		3				59
	1				32	11		3				60
	1				32	11		3				61
	1				33	11		3				62
	1				34	11		3				63
$860	$21,843	$11,459	$733	$3,908	$89,618	$109,133	$11,059	$29,045	$577	$755	$4,449	64
$450	$8,438	$1,768	$417	$1,104	$1,056	$29,487	$2,177	$6,325	$424	$340	$1,708	65
	$486	$759	$16	$98	$3,884	$1,243	$103	$398	$23	$55	$363	66
$410	$12,592	$8,932	$300	$2,706	$84,678	$77,898	$8,779	$22,322	$130	$360	$2,378	67
	$327					$505						68
$930	$93,276	$35,097	$881	$13,082	$317,852	$303,115	$12,818	$43,497	$383	$1,276	$9,133	69
$619	$78,481	$26,244	$545	$11,950	$119,481	$241,698	$9,366	$40,313	$225	$700	$7,621	70
$1	$2,976				$50	$2,388	$300		$50			71
$618	$75,505	$26,244	$545	$11,950	$119,431	$239,310	$9,066	$40,313	$175	$700	$7,621	72
$51	$2,320	$920	$15	$349	$4,858	$2,221	$390	$1,651	$38	$16	$95	73
$75	$1,375	$1,257	$106	$60	$2,720	$8,706	$280	$990		$60	$129	74
$5	$277	$526		$110	$2,340	$1,643	$54	$281			$3	75
$155	$10,667	$4,968	$215	$524	$186,553	$45,912	$1,500	$183	$120	$500	$1,285	76
$25	$156	$1,182		$89	$1,900	$2,935	$1,228	$79				77

TABLE 20.—MUSICAL INSTRUMENTS AND MATERIALS, NOT

		United States.	California.	Connecticut.	Illinois.	Indiana.
78	Value of products, including amount received for custom work and repairing	$3,481,710	$8,145	$6,250	$674,370	$351,832
	Power:					
79	Number of establishments reporting	92		2	18	4
80	Total horsepower	1,631		3	255	125
	Owned—					
	Engines—					
	Steam—					
81	Number	24			1	2
82	Horsepower	766			150	65
	Gas and gasoline—					
83	Number	15			5	2
84	Horsepower	109			28	12
	Water wheels—					
85	Number	5				1
86	Horsepower	128				38
	Electric motors—					
87	Number	2				
88	Horsepower	28				
89	Other power, horsepower	2				
	Rented—					
	Electric motors—					
90	Number	61		2	11	1
91	Horsepower	336		3	55	10
92	Other kind, horsepower	262			22	

SPECIFIED—DETAILED SUMMARY, BY STATES: 1905—Continued.

Maryland.	Massachusetts.	Michigan.	Minnesota.	Missouri.	New Jersey.	New York.	Ohio.	Pennsylvania.	Washington.	Wisconsin.	All other states.	
$7,110	$259,445	$123,912	$9,125	$47,744	$862,886	$888,423	$30,049	$173,215	$4,247	$6,200	$28,757	78
1	10	4	2	2	5	27	3	10	...	2	2	79
2	197	70	11	7	373	430	75	61	...	2	20	80
...	2	1	...	1	8	5	1	3	...	...	...	81
...	60	35	...	5	305	78	35	33	...	...	...	82
...	...	...	...	...	...	5	1	1	...	...	1	83
...	...	...	...	...	...	34	20	10	...	...	5	84
...	4	...	...	...	...	...	...	...	...	...	...	85
...	90	...	...	...	...	...	...	...	...	...	...	86
...	...	...	...	...	1	...	1	...	...	...	...	87
...	...	...	...	...	25	...	[illegible]	...	...	...	...	88
...	...	...	...	...	...	2	...	...	...	...	...	89
1	9	8	2	1	2	14	2	5	...	2	1	90
2	16	35	11	2	43	109	17	16	...	2	15	91
...	31	...	...	...	...	207	...	2	...	...	...	92

PHONOGRAPHS AND GRAPHOPHONES.

Statistics concerning the manufacture of phonographs, graphophones, and supplies were presented in 1900 in connection with the special report on electrical apparatus and supplies,[1] inasmuch as this apparatus was invented and largely perfected by electricians, or those particularly interested in electricity. The only portion of the instrument, however, that is ever electrical in operation is the motor, which is sometimes arranged for attachment to the incandescent light wire or has a storage battery attachment, the current thus obtained furnishing the power.

For the reason, therefore, that this class of instruments may not properly be considered as electrical apparatus and as it is now considerably used in reproducing music and its introduction to the public is largely through the medium of music dealers, the statistics are presented with the report on the manufacture of musical instruments and materials. The figures given are not included with the combined statistics on musical instrument manufacture, but are presented in separate form and include not only the manufacture of the finished instrument but also phonograph and graphophone supplies and disk and cylinder records, when the same were manufactured by establishments classified under this head.

Table 21 is a comparative summary of statistics for the United States, showing the per cent of increase during the five-year period, 1900 and 1905.

TABLE 21.—*Phonographs and graphophones—comparative summary, with per cent of increase: 1905 and 1900.*

	1905	1900	Per cent of increase.
Number of establishments	14	11	27.3
Capital	$8,740,618	$3,348,282	161.0
Salaried officials, clerks, etc., number	537	144	272.9
Salaries	$666,489	$179,145	272.0
Wage-earners, average number	3,397	1,267	168.1
Total wages	$1,683,903	$608,490	176.7
Men 16 years and over	3,025	1,114	171.5
Wages	$1,564,625	$565,076	176.9
Women 16 years and over	364	146	149.3
Wages	$117,859	$42,914	174.6
Children under 16 years	8	7	14.3
Wages	$1,419	$500	183.8
Miscellaneous expenses	$1,653,762	$215,401	667.8
Cost of materials used	$4,161,136	$827,529	402.8
Value of products	$10,237,075	$2,246,274	355.7

There was an increase of but 3 establishments in the five years intervening between the two censuses, and, as these 3 establishments reported a very small product, the large increase in production has occurred without any corresponding increase in the number of establishments reporting. This concentration of manufacture in a few large companies is due to the possession of patents which enables them to retain the rights to sole production.

Table 21 shows that in 1900 the capital invested was 49.1 per cent larger than the value of products reported, while in 1905 the value of products was considerably larger, being 17.1 per cent more than the capital. This results naturally from the fact that at the last census the industry was in its infancy, and costly experiments were constantly being made which required the expenditure of large sums of money with, in some instances, comparatively little return. Experiments are still being made and expensive laboratories are maintained in the principal factories, where new materials are tested and other improvements are designed and worked out by experts; but in the main the production of phonographs and graphophones is past the experimental stage and their commercial position is assured. Thus at the census of 1905 the productive power of the capital invested was utilized much more completely than in 1900, and the alteration in the relation of capital to products at the two periods resulted.

The item of miscellaneous expense is apparently a very important factor in the cost of production of phonographs and graphophones. At the census of 1905 the amount expended for this item nearly equaled the expenditure for labor. This is due to the cost of extensive advertising and the large amounts expended to secure records of famous bands and professional soloists, items which are included in the total of miscellaneous expense.

The principal centers of the industry are Camden and Orange, N. J.; Bridgeport, Conn.; Toledo, Ohio; and New York city.

Table 22 is a summary of products of establishments manufacturing phonographs, graphophones, disk or cylinder records, and phonograph and graphophone supplies, as reported at the censuses of 1900 and 1905, showing the per cent each item is of the total for each census and also the per cent of increase during the five-year period.

TABLE 22.—*Phonographs and graphophones—products, by kind and value, with per cent of total and per cent of increase: 1905 and 1900.*

KIND.	1905		1900		Per cent of increase.
	Value.	Per cent of total.	Value.	Per cent of total.	
Total	$10,237,075	100.0	$2,246,274	100.0	355.7
Phonographs and graphophones	2,966,343	29.0	1,240,503	55.2	139.1
Disk and cylinder records	4,678,547	45.7	539,370	24.0	767.4
All other products	2,592,185	25.3	466,401	20.8	455.8

The total value of phonographs and graphophones manufactured in 1905 was but 29 per cent of the total product reported for the industry at that census, while the value of disk and cylinder records manufactured represented 45.7 per cent of the same total. In 1900 the proportions were reversed, the value of finished instruments manufactured amounting to 55.2 per cent of the total, and the value reported for

[1] Twelfth Census, Manufactures, Part IV, page 181.

disk and cylinder records to but 24 per cent of the total. This change in the relative importance of the two branches of the industry was not due to any falling off in the production of phonographs and graphophones, which increased largely during the five years, but to the far greater increase in the production of disk and cylinder records. As the machines themselves become more widely distributed, the manufacture of disk and cylinder records is sure to continue to increase at the same extraordinary rate. Every phonograph and graphophone sold creates a demand for records that results in sales which ordinarily far exceed in value the initial cost of the machine itself.

The value reported for this industry includes in some instances a product which can not be classed under either the finished instrument or disk and cylinder records. For instance, a large establishment in Philadelphia reports the exclusive manufacture of talking machine supplies, the value of which is included in Table 22 under the head of "all other products," and items of this nature are probably duplicated to a certain extent in the values reported for phonographs and graphophones by establishments manufacturing the finished product. In these latter establishments, under the heading materials used, there is reported a large expenditure for materials such as horns, cylinder cases, etc., which are reported as finished products of plants producing such supplies, and thus their values are included twice in the aggregate for the industry. It is impossible to measure the extent of this duplication, but its presence should be noted when the value reported for the industry is under consideration.

In addition to phonograph and graphophone supplies there is also included in "all other products" a number of miscellaneous articles not related to the industry—for instance, billiard balls and game markers, composition novelties, electrical specialties, numbering machines, etc.—reported by establishments whose principal product is phonographs, graphophones, records, and supplies. This value, however, is of little consequence in comparison with the grand total.

The history of the phonograph and graphophone can be found in the special report on electrical apparatus and supplies,[1] and therefore minute details will not be given in this report. Briefly stated, the principal features of the instrument are the motor, the recording and reproducing mechanism, and the record, which is flat or cylindrical according to the type of machine.

Electricity is sometimes used as motive power, especially for office dictation instruments, but the large majority of phonographs and graphophones manufactured are operated by clockwork with a tandem spring wind. The motor is arranged to turn the mandrel holding the record, and there is a delicately adjusted "governor" arranged to regulate the speed, thus retarding or accelerating the action as required.

In making a record the sound waves received in the horn of the instrument and transmitted through the sound passage, agitate the sensitive mica or glass diaphragm, which is about one one-hundred and fiftieth of an inch in thickness and from an inch and one-fourth to 2 inches in diameter. A small cutting chisel or point is attached to the diaphragm for the purpose of recording these vibrations on a blank wax record. This original or master record is then electrotyped for permanent use and duplicate records are made from an exact gold-plated copper mold negative.

The reproduction of sound from records is practically a reversal of the process of making. The reproducer point for use on cylinder records is a sapphire ball, and the sound markings are in the form of engravings about one one-thousandth of an inch in depth; whereas in a disk machine a metal reproduction needle is used and the markings are delicate zigzag lines about 100 to the inch. The stylus, resting on a revolving cylinder record, is moved rapidly up and down, agitating a horizontal diaphragm, while the needle of a disk machine is moved from left to right and vice versa, agitating a diaphragm attached to the needle obliquely with the record. This vibration produces the sound passage—sound waves which are practically identical with those originally communicated to the master record. The size and construction of the horn are important to successful results, inasmuch as it prevents the sound waves from becoming scattered. In commercial use, in teaching languages, and in all instances where there is but one listener, tubes are used in place of the horn.

Table 23 is a detailed summary for this industry at the census of 1905.

[1] Twelfth Census, Manufactures, Part IV, page 181.

TABLE 23.—PHONOGRAPHS AND GRAPHOPHONES—DETAILED SUMMARY, BY STATES: 1905.

	United States.	New Jersey.	All other states.[1]
Number of establishments	14	4	10
Capital, total	$8,740,618	$3,574,316	$5,166,302
Land	$260,000	$130,000	$130,000
Buildings	$563,779	$345,264	$218,515
Machinery, tools, and implements	$1,361,545	$755,784	$605,761
Cash and sundries	$6,555,294	$2,343,268	$4,212,026
Proprietors and firm members	6	....	6
Salaried officials, clerks, etc.:			
Total number	537	283	254
Total salaries	$666,489	$318,924	$347,565
Officers of corporations—			
Number	32	13	19
Salaries	$218,329	$88,818	$129,511
General superintendents, managers, clerks, etc.—			
Total number	505	270	235
Total salaries	$448,160	$230,106	$218,054
Men—			
Number	427	231	196
Salaries	$411,216	$212,308	$198,908
Women—			
Number	78	39	39
Salaries	$36,944	$17,798	$19,146
Wage-earners, including pieceworkers, and total wages:			
Greatest number employed at any one time during the year	4,189	2,204	1,985
Least number employed at any one time during the year	2,547	1,601	946
Average number	3,397	1,967	1,430
Total wages	$1,683,903	$959,104	$724,799
Men 16 years and over—			
Average number	3,025	1,710	1,315
Wages	$1,564,625	$876,185	$688,440
Women 16 years and over—			
Average number	364	251	113
Wages	$117,859	$82,050	$35,809
Children under 16 years—			
Average number	8	6	2
Wages	$1,419	$869	$550
Average number of wage-earners, including pieceworkers, employed during each month:			
Men 16 years and over—			
January	3,180	1,754	1,426
February	3,354	1,737	1,617
March	3,258	1,618	1,640
April	3,151	1,658	1,493
May	2,782	1,526	1,256
June	2,617	1,622	995
July	2,617	1,654	963
August	2,746	1,721	1,025
September	2,997	1,782	1,215
October	3,208	1,829	1,379
November	3,229	1,824	1,405
December	3,161	1,795	1,366
Women 16 years and over—			
January	375	263	112
February	441	269	172
March	421	244	177
April	365	240	125
May	331	240	91
June	302	235	67
July	302	238	64

	United States.	New Jersey.	All other states.
Average number of wage-earners, including pieceworkers, employed during each month—Continued.			
Women 16 years and over—Continued.			
August	308	244	64
September	343	255	88
October	413	258	155
November	412	262	150
December	355	264	91
Children under 16 years—			
January	9	7	2
February	10	8	2
March	9	7	2
April	9	7	2
May	8	6	2
June	7	5	2
July	8	6	2
August	7	5	2
September	7	5	2
October	7	5	2
November	8	6	2
December	7	5	2
Miscellaneous expenses, total	$1,653,762	$1,302,425	$351,337
Rent of works	$23,089	$8,892	$14,197
Taxes	$7,948	$3,578	$4,370
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$1,618,485	$1,289,365	$329,120
Contract work	$4,240	$590	$3,650
Materials used, aggregate cost	$4,161,136	$2,370,202	$1,790,934
Principal materials, total cost	$2,795,443	$1,169,735	$1,625,708
Purchased in raw state	$2,965	$2,965	....
Purchased in partially manufactured form	$2,792,478	$1,166,770	$1,625,708
Fuel	$29,520	$16,461	$13,059
Rent of power and heat	$22,341	$16,411	$5,930
Mill supplies	$61,433	$34,316	$27,117
All other materials	$1,142,379	$1,045,560	$96,819
Freight	$110,020	$87,719	$22,301
Value of products, including amount received for custom work and repairing	$10,237,075	$5,931,835	$4,305,240
Power:			
Number of establishments reporting	13	4	9
Total horsepower	2,812	1,782	1,030
Owned—			
Engines—			
Steam—			
Number	9	7	2
Horsepower	1,905	1,075	830
Gas and gasoline—			
Number	2	....	2
Horsepower	9	....	9
Electric motors—			
Number	14	8	6
Horsepower	290	200	90
Other power, horsepower	2	....	2
Rented—			
Electric motors—			
Number	12	6	6
Horsepower	181	107	74
Other kind, horsepower	425	400	25
Furnished to other establishments, horsepower	10	10	....

[1] Includes establishments distributed as follows: Connecticut, 4; Illinois, 1; New York, 2; Ohio, 1; Pennsylvania, 2.

AUTOMOBILES

AUTOMOBILES.

By George E. Oller.

In five years the manufacture of automobiles in the United States has grown from an industry so unimportant that it was not reported separately at the census of 1900 to one with products valued at $26,645,064 at the census of 1905, which covered the calendar year 1904. This remarkable growth is not, like that of the bicycle, based on a fad, and so liable to as sudden a decline. Unlike the bicycle, the automobile is not essentially a new vehicle, but merely a carriage or truck with a new means of propulsion, possessing many advantages over a vehicle drawn by horses. As a means of amusement its popularity may fluctuate or decline, but its practical value has been so thoroughly demonstrated that its use will doubtless become more general each succeeding year, until it is displaced by some vehicle as much its superior as the automobile is the superior of the horse and wagon.

In this report the industry is first taken up statistically, and most of this statistical discussion has to do only with the figures for establishments manufacturing automobiles as a principal product. At the end of this presentation there are briefly taken up, in the order named, automobiles as a minor product; the closely allied industries, "automobile bodies and parts" and "rubber and elastic goods;" and exports and imports of automobiles. A detailed summary of the industry closes the report. Under the historical and descriptive section which follows the statistical discussion the development of the modern automobile, motors, frame, wheels, and body are taken up in the order named.

At the census of 1905, for the first time, the manufacture of automobiles was returned as a separate industry. At preceding censuses the statistics for the industry were included under those for carriages and wagons. However, the figures for 1900 of establishments engaged exclusively in the manufacture of automobiles, or with a preponderating automobile product, have been separated from the reports for the carriage and wagon industry, and are presented in Tables 1 and 2 for purposes of comparison.

Table 1 is a comparative summary of the statistics of the industry for 1900 and 1905.

Table 1.—*Comparative summary, with per cent of increase: 1905 and 1900.*

	CENSUS.		Per cent of increase.
	1905 [1]	1900	
Number of establishments	121	57	112.3
Capital	$20,555,247	$5,768,857	256.3
Salaried officials, clerks, etc	954	268	256.0
Salaries	$1,076,425	$294,770	265.2
Wage-earners, average number	10,239	2,241	356.9
Total wages	$6,178,950	$1,320,658	367.9
Men 16 years and over	10,196	2,231	357.0
Wages	$6,167,345	$1,317,715	368.0
Women 16 years and over	11	4	175.0
Wages	$3,689	$977	262.7
Children under 16 years	32	6	433.3
Wages	$7,916	$1,966	302.6
Miscellaneous expenses	$3,946,369	$281,129	1,303.8
Cost of materials used	$11,658,138	$1,804,287	546.1
Value of products	$26,645,064	$4,748,011	461.2

[1] Exclusive of the statistics of establishments engaged primarily in the manufacture of other products and which manufactured automobiles to the value of $879,205.

At the census of 1905 compared with that of 1900 the number of establishments increased 64; the capital, $14,786,390; the number of salaried officials, 686; the average number of wage-earners, 7,998; the cost of materials, $9,853,851; and the total value of products, $21,897,053.

The relatively small increase in number of establishments is due to the fact that the majority reported in 1900 were engaged largely in experimental work, with little capital invested, and employing few workmen. Growth has been along the line of extending the capacity of the old plants, or abandoning them for new and much larger ones, rather than in increasing the number of establishments.

Table 2 shows the items of miscellaneous expenses for 1900 and 1905.

Table 2.—*Miscellaneous expenses: 1905 and 1900.*

	1905	1900
Total	$3,946,369	$281,129
Rent of works	88,497	40,133
Taxes	77,625	10,228
Sundries and rent of offices	2,745,601	226,548
Contract work	1,034,646	4,220

Although the extension of the industry has largely added to the amount expended for contract work, the

largest part of the increase in miscellaneous expenses is due to the cost of advertising, outside office expenses, etc.

The relatively small increase in rent of works is due to the fact that many companies are now housed in new, commodious quarters of their own, whereas in 1900 they occupied small rented quarters.

Table 3 is a comparative summary of the statistics for the manufacture of automobiles, by states, for 1900 and 1905.

Table 3.—COMPARATIVE SUMMARY, BY STATES: 1905 AND 1900.

STATE.	Census.	Number of establishments.	Capital.	Salaried officials, clerks, etc.		Wage-earners and wages.							
						Total.		Men 16 years and over.		Women 16 years and over.		Children under 16 years.	
				Number.	Salaries.	Average number.	Wages.	Average number.	Wages.	Average number.	Wages.	Average number.	Wages.
United States	1905	121	$20,555,247	954	$1,076,425	10,239	$6,178,950	10,196	$6,167,345	11	$3,689	32	$7,916
	1900	57	5,768,857	268	294,770	2,241	1,320,658	2,231	1,317,715	4	977	6	1,966
California[1]	1905	6	48,802	3	4,800	14	10,124	14	10,124	....	....	....	....
Connecticut[2]	1905	7	3,712,922	62	86,372	1,065	783,993	1,057	781,604	....	....	8	2,389
Illinois	1905	8	378,536	15	26,180	146	100,433	146	100,433	....	....	....	....
	1900	4	974,894	36	27,523	303	217,603	299	215,949	....	....	4	1,654
Indiana[2]	1905	8	1,140,509	94	74,293	789	482,198	784	480,456	3	1,326	2	416
Maryland[3]	1900	3	81,600	8	7,900	26	16,325	26	16,325	....	....	....	....
Massachusetts	1905	11	1,623,857	98	115,832	952	596,277	944	594,082	1	300	7	1,895
	1900	12	475,512	18	24,157	303	188,098	303	188,098	....	....	....	....
Michigan[1]	1905	22	3,765,240	151	188,452	2,123	970,895	2,122	970,770	1	125	....	....
New Jersey	1905	5	310,261	22	13,662	60	40,296	59	40,248	....	....	1	48
	1900	4	762,500	35	53,808	201	143,840	201	143,840	....	....	....	....
New York	1905	21	3,172,531	200	202,869	1,624	1,095,470	1,618	1,094,120	1	288	5	1,062
	1900	15	638,553	56	56,632	288	166,051	283	164,882	3	857	2	312
Ohio	1905	14	3,544,162	172	218,950	2,277	1,368,810	2,272	1,367,160	5	1,650	....	....
	1900	3	68,500	7	5,405	86	51,826	86	51,826	....	....	....	....
Pennsylvania	1905	6	1,452,963	65	78,681	566	352,482	566	352,482	....	....	....	....
	1900	8	297,100	16	17,629	60	43,247	60	43,247	....	....	....	....
Wisconsin[2]	1905	6	1,240,006	59	54,180	520	299,624	511	297,518	....	....	9	2,106
All other states	[4] 1905	7	165,458	13	12,154	103	78,348	103	78,348	....	....	....	....
	[5] 1900	8	2,470,198	92	101,716	974	493,668	973	493,548	1	120	....	....

STATE.	Census.	Miscellaneous expenses.	Cost of materials used.	Products.										
				Aggregate value.	Automobiles.								All other products.	Amount received for custom work and repairing.
					Total.		Gasoline.		Electric.		Steam.			
					Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Value.	
United States	1905	$3,946,369	$11,658,138	$26,645,064	21,692	$23,751,234	18,699	$19,566,941	1,425	$2,496,255	1,568	$1,688,038	$2,042,777	$851,053
	1900	281,129	1,804,287	4,748,011	3,723	4,548,108	(6)	(6)	(6)	(6)	(6)	(6)	126,079	73,824
California[1]	1905	10,139	12,863	36,380	12	13,606	12	13,606	....	....	....	....	1,761	21,013
Connecticut[2]	1905	466,851	1,163,072	2,644,334	832	1,958,682	386	1,125,863	319	747,420	127	85,399	331,253	354,399
Illinois	1905	61,721	104,390	327,710	205	262,691	66	56,800	139	205,891	....	....	23,290	41,729
	1900	55,627	291,653	747,777	660	747,777	....	....	....	....	....	....	....	....
Indiana[2]	1905	230,226	811,823	1,595,302	1,020	1,428,463	595	1,034,519	424	391,444	1	2,500	114,963	51,876
Maryland[3]	1900	3,345	30,882	64,700	25	55,500	....	....	....	....	....	....	2,700	6,500
Massachusetts	1905	228,504	1,047,488	2,160,455	2,365	2,052,943	1,765	1,662,943	....	....	600	390,000	78,907	28,605
	1900	47,094	306,645	769,397	1,132	757,242	....	....	....	....	....	....	12,150	5
Michigan[1]	1905	1,423,167	2,872,655	6,876,708	9,125	6,552,804	9,114	6,537,404	11	15,400	....	....	276,680	47,224
New Jersey	1905	40,459	43,905	118,753	51	71,400	6	12,500	15	25,900	30	33,000	36,050	11,303
	1900	36,860	175,508	478,680	213	423,550	....	....	....	....	....	....	5,980	49,150
New York	1905	565,776	1,764,567	3,791,956	1,808	3,071,093	1,496	2,169,093	307	892,000	5	10,000	494,608	226,255
	1900	19,710	172,973	455,911	521	374,947	....	....	....	....	....	....	66,644	14,320
Ohio	1905	677,374	2,208,651	5,788,563	2,808	5,197,360	1,811	3,853,621	200	196,000	797	1,147,739	554,642	36,561
	1900	13,918	60,344	145,000	132	145,000	....	....	....	....	....	....	....	....
Pennsylvania	1905	61,795	601,430	1,225,678	963	1,134,776	955	1,116,176	8	18,600	....	....	83,183	7,719
	1900	32,707	31,089	98,884	65	66,400	....	....	....	....	....	....	29,484	3,000
Wisconsin[2]	1905	163,995	845,348	1,875,259	2,390	1,856,694	2,388	1,853,094	2	3,600	....	....	16,080	2,485
All other states	[4] 1905	16,362	91,946	203,966	113	150,722	105	131,322	....	....	8	19,400	31,360	21,884
	[5] 1900	71,868	735,193	1,987,662	975	1,977,692	....	....	....	....	....	....	9,121	849

[1] No establishments reported in 1900.
[2] Included in "all other states" in 1900.
[3] No establishments reported in 1905.
[4] Includes establishments distributed as follows: Kansas, 1; Maine, 1; Minnesota, 1; Missouri, 1; New Hampshire, 1; Rhode Island, 2.
[5] Includes establishments distributed as follows: Connecticut, 2; Indiana, 1; Maine, 2; Missouri, 1; New Hampshire, 1; Wisconsin, 1.
[6] Not reported separately.

Table 3 shows that the manufacture of automobiles was carried on in 13 states in 1900, and in 17 in 1905. At the census of 1905 Michigan, with 22 establishments, ranked first. New York stood second, with 21, and Ohio third, with 14. Massachusetts, with 11 establishments; Illinois and Indiana, with 8 each; Connecticut, with 7; California, Pennsylvania, and Wisconsin, with 6 each; and New Jersey, with 5, followed in the order named.

Michigan, from which state no establishments were reported in 1900, held first rank in capital invested in 1905, the amount being $3,765,240. Connecticut, with $3,712,922, dropped from first place in 1900 to second in 1905. Ohio, with an increase of $3,475,662, more than fiftyfold, advanced from eighth rank to third; Massachusetts, with an increase of $1,148,345, from fifth to fourth; and Pennsylvania, with an increase of $1,155,863, nearly fourfold, from sixth to fifth. Wisconsin, with $1,240,006, and Indiana, with $1,140,509, both of which reported but 1 establishment in 1900, ranked sixth and seventh, respectively, in 1905. With the enormous general increase in the industry, it is surprising to note the following decreases: Illinois fell from second to eighth place, reporting a decrease of $596,358, or 61.2 per cent; and New Jersey, from third to ninth place, with a decrease of $452,239, or 59.3 per cent. Maryland reported $81,600 capital in 1900 and none at all in 1905. In 1900 Connecticut was the only state that reported a total capital in excess of $1,000,000, while there were 8 states in this class in 1905.

From Table 3 it is evident that the average capital per establishment increased materially between 1900 and 1905. For the entire country the advance was from $101,208 in 1900 to $169,878 in 1905, an increase of $68,670, or 67.9 per cent.

The number of wage-earners increased from 2,241 in 1900 to 10,239 in 1905. At the census of 1900 Connecticut ranked first both in number of wage-earners and total wages paid. In number of wage-earners Illinois and Massachusetts followed, each having 303. In wages paid Illinois stood second, with $217,603, and Massachusetts third, with $188,098. New York stood fourth both in number of wage-earners and in wages paid, and New Jersey fifth. These 5 states reported a total of 1,990 wage-earners, receiving $1,168,331 in wages, 88.8 and 88.5 per cent, respectively, of the totals for the country.

In number of wage-earners in 1905 Ohio stood first, with 2,277, an increase of 2,191. Michigan followed, with 2,123. New York, with 1,624, an increase of 1,336, advanced from fourth to third in rank. Connecticut, with 1,065, fell from first to fourth place. Massachusetts, though reporting an increase of 649, fell from second to fifth place. Indiana, Pennsylvania, and Wisconsin followed in the order named. In amount of wages paid in 1905 the states ranked in the same order with a single exception, New York exchanging places with Michigan.

The inconsiderable number of women and children employed is noteworthy. This is due to the fact that the labor requires physical strength and a high degree of mechanical skill. In 1900 only 4 women were employed in the entire United States, 3 of whom were reported by New York. In 1905 the number had increased to only 11. In 1900 only 6 children were employed, and in 1905 but 32.

From Table 3 it will be observed that the relation of the cost of materials to the value of product is practically constant, at least to the extent that the states occupy the same rank, whether arranged according to the cost of materials or according to value of product. This is true for both 1900 and 1905. At the census of 1905 Michigan had advanced to first rank in these two respects. Ohio had risen from sixth to second place, with an increase of $2,238,307 in cost of materials, and an increase of $5,643,563 in value of products. New York advanced from fifth to third place, with an increase of $1,591,594 in cost of materials and $3,336,045 in value of products. Connecticut fell from first to fourth place, though showing an increase of $464,800 in cost of materials and $752,492 in value of products; and Massachusetts from second to fifth, though showing an increase of $740,843 in cost of materials and $1,391,058 in value of products. Wisconsin occupied sixth place in 1905 and Indiana seventh.

In an industry characterized by such marked increases, the decreases reported in nearly every item for the 3 states, Illinois, Maryland, and New Jersey, are notable. The largely experimental stage of the industry and local conditions, such as the removal of factories, are responsible for the decreases.

In 1900 "all other products" included for the most part horse-drawn vehicles manufactured in connection with automobiles, while at the census of 1905 the item represented entirely gas engines, batteries, parts, and finishings, manufactured in excess of the number required for the automobiles turned out. Comparison is therefore impracticable. It is of interest, however, to note the gradual change in certain establishments to meet the new conditions. The change in the character of the "all other products" indicates the abandonment in certain plants of the manufacture of horse-drawn vehicles in favor of the automobile. This item for 1905 shows the extent to which the manufacture of parts overreached the production of the finished automobile.

The amount received for custom work and repairing increased from $73,824 in 1900 to $851,053 at the census of 1905. These amounts represent repair work almost exclusively, and show the extent to which the manufactories are called upon to do this class of work, which is largely on vehicles of their own make. This

does not represent the full extent of the repairing, however, as much of this class of work is done at the local garage in which the machine is housed.

At the census of 1900 only the total number and value of automobiles were reported, regardless of the kind of power used. For the entire United States there were reported 3,723, valued at $4,548,108, an average value of $1,222. Of the various states, Massachusetts produced the greatest number of vehicles, the average value being $669. Connecticut ranked second in the number turned out, the average value being $2,114. Illinois ranked third, with an average value of $1,133; New York, fourth, with an average value of $720; and New Jersey, fifth, with an average value of $1,988.

At the census of 1905 21,692 automobiles were manufactured, valued at $23,751,234, having an average value of $1,095. Of this number, 18,699, or 86.2 per cent, were propelled by gasoline; 1,425, or 6.6 per cent, by electricity; and 1,568, or 7.2 per cent, by steam. The average prices per vehicle were $1,046 for the gasoline, $1,752 for the electric, and $1,077 for the steam. Michigan held to first rank in respect to the number turned out. Only one-tenth of 1 per cent were electric and the remainder gasoline. The total average price was $718. Ohio advanced from sixth place in 1900 to second in 1905, with an average value of $1,851 at the later census. Of this state's output, 64.5 per cent were gasoline; 7.1 per cent electric; and 28.4 per cent steam. Wisconsin ranked third with 2,390 vehicles, only 2 of which were electric and the rest gasoline. The average value was only $777, owing to the fact that they were mostly runabouts. Massachusetts, first in 1900 in the number of machines turned out, dropped to fourth place in 1905. Of the total, 25.4 per cent were steam and the remainder gasoline. The total average value was $868. New York fell from fourth to fifth place. Of the 1,808 vehicles made in the year covered by the census, 82.7 per cent were gasoline; 17 per cent electric; and only three-tenths of 1 per cent steam. However, on account of the large average value of all machines, $1,699, New York ranked third in value of product. These 5 states taking precedence as to the number of automobiles manufactured, reported in 1905 a total of 18,496 vehicles, or 85.3 per cent of the total for the country, having a value of $18,730,894, or 78.9 per cent of the total value of all machines manufactured in the United States.

Table 4 shows the chief classes of automobiles manufactured, with their number and value, and distribution, by kind of power used.

Table 4.—NUMBER AND VALUE OF AUTOMOBILES, BY CLASS AND KIND OF POWER USED: 1905.

CLASS.	TOTAL.		GASOLINE.		ELECTRIC.		STEAM.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Aggregate	21,692	$23,751,234	18,699	$19,566,941	1,425	$2,496,255	1,568	$1,688,038
Touring car[1]	7,220	11,781,521	6,444	10,576,023	39	55,038	737	1,150,460
Runabout[1]	12,131	8,831,504	10,999	7,976,821	455	453,304	677	401,379
Stanhope	520	614,104	206	298,550	209	255,217	105	60,337
Delivery, heavy	160	491,490	55	50,390	105	441,100	...	...
Delivery, light	251	455,457	140	215,897	109	235,560	2	4,000
Surrey	221	229,872	131	108,810	45	57,200	45	63,862
Victoria	66	77,740	...	...	66	77,740	...	...
Phaeton	49	69,450	48	68,250	1	1,200	...	...
Doctor's wagon or car	54	47,140	1	500	53	46,640	...	...
Station wagon or car	13	25,800	...	...	13	25,800	...	...
All other varieties	1,007	1,127,156	675	271,700	330	847,456	2	8,000

[1] Does not include 729 runabouts, valued at $438,596, and 210 touring cars, valued at $204,934, manufactured as a minor product in establishments principally engaged in other lines of manufacture. In addition 199 automobiles, valued at $235,675, manufactured in carriage and wagon factories, are not included in this table, because the classes and power were not reported.

Table 4 shows that 12,131, or 55.9 per cent, of the total number of automobiles manufactured in the United States were runabouts. Of these, 90.7 per cent were gasoline; 3.7 per cent electric; and 5.6 per cent, steam. Less in number, though greater in aggregate value, were the touring cars, constituting 33.3 per cent of the total vehicles turned out. Of this class, 89.3 per cent were propelled by gasoline, 10.2 per cent by steam, and only five-tenths of 1 per cent by electricity. Stanhopes were fourth in point of number, of which 39.6 per cent were gasoline, 40.2 per cent electric, and 20.2 per cent steam. Light and heavy delivery wagons ranked next, of which 47.4 per cent were gasoline, 52.1 per cent electric, and five-tenths of 1 per cent steam. The figures for delivery wagons indicate that electricity is the preferred motive power for the heaviest vehicles.

Under "other varieties" are classed broughams, landaulets, omnibuses, sight-seeing coaches, buckboards, etc.

Michigan produced 6,432 runabouts, having an average value of $631. These runabouts constituted 70.5 per cent of all automobiles manufactured in the state and 53 per cent of the total runabouts manufactured in the United States. All but 11 were propelled by gasoline. Michigan also ranked first in touring cars, report-

ing 2,561, or 35.5 per cent, of all of this class of automobiles manufactured in the country. Their average value was $938.

Ohio produced 186 runabouts, valued at an average of $670; 2,521 touring cars, valued at an average of $1,971; and 100 electric stanhopes, valued at an average of $1,000. This state turned out 34.9 per cent of all the touring cars made in the country. Michigan and Ohio together turned out 70.4 per cent of all such vehicles manufactured in the United States.

Of the 2,390 vehicles made in Wisconsin, 2,358 were runabouts, averaging $775 in value. Among the automobiles manufactured in Massachusetts there were 1,153 runabouts, valued at $708 apiece; 361 touring cars, valued at $1,918 apiece; 105 surreys, valued at $1,046 apiece; and 73 light delivery wagons, valued at $2,255 apiece. The greater number of machines manufactured in New York consisted of runabouts, having an average value of $1,075. The 397 touring cars turned out had an average value of $2,509.

Table 5 gives the average value of the different classes and kinds of automobiles manufactured.

Table 5.—*Average value of automobiles, by class and kind of power used: 1905.*

CLASS.	All kinds of power.	Gasoline.	Electric.	Steam.
Aggregate	$1,095	$1,046	$1,752	$1,077
Touring car	1,632	1,641	1,411	1,561
Runabout	728	725	996	593
Stanhope	1,181	1,449	1,221	575
Delivery, heavy	3,072	916	4,201	....
Delivery, light	1,815	1,542	2,161	2,000
Surrey	1,040	831	1,271	1,419
Victoria	1,178	....	1,178	....
Phaeton	1,417	1,422	1,200	....
Doctor's wagon or car	873	500	880	....
Station wagon or car	1,215	....	1,215	....
All other varieties	1,119	403	2,568	4,000

A noticeable feature of Table 5 is the variation indicated in the average values of the same class of machine when equipped with different kinds of propelling power. Where the power is different in vehicles of the same class, the structure is entirely changed.

The average values given are based on the prices at the factory and in no case represent the average selling prices to the consumer. In the 5 leading states the average value of runabouts varied as follows: Michigan, $631; Ohio, $670; Wisconsin, $775; Massachusetts, $708; and New York, $1,075. The average value of touring cars varied still more: Michigan, $938; Ohio, $1,971; Massachusetts, $1,918; and New York, $2,509.

In order to show the remarkable changes in the relative positions of the leading states in this industry, Table 6 is presented, showing their rank with respect to the principal items of inquiry for 1900 and 1905.

The states selected for this table are the 7 leading states in value of products in 1905. The same rank in any item of inquiry was retained at the two censuses in only five cases. Michigan made the most marked advance, from no standing at all in the industry in 1900 to first in most respects at the census of 1905. Connecticut, first in most respects in 1900, dropped from one to three points in all items of inquiry. Ohio advanced from two to five points in every item. New York retained about the same relative position at both censuses, having varied none at all in respect to two of the six items and not more than two points in any of the others. In the amount of capital the rank of Massachusetts remained unchanged, but this state fell from two to three points in each of the other items. Indiana advanced from one to four points in every item. In the number of establishments the rank of Wisconsin remained the same, but this state advanced from two to five points in each of the other items.

Table 6.—RANK OF LEADING STATES WITH RESPECT TO PRINCIPAL ITEMS OF INQUIRY: 1905 AND 1900.

STATE.	NUMBER OF ESTABLISHMENTS.		CAPITAL.		WAGE-EARNERS AND WAGES.				COST OF MATERIALS USED.		VALUE OF PRODUCTS.	
					Average number.		Wages.					
	1905	1900	1905	1900	1905	1900	1905	1900	1905	1900	1905	1900
Michigan	1	(1)	1	(1)	2	(1)	3	(1)	1	(1)	1	(1)
Ohio	3	5	3	8	1	5	1	6	2	6	2	6
New York	2	1	4	4	3	3	2	4	3	5	3	5
Connecticut	[illegible]	6	2	1	4	1	4	1	4	1	4	1
Massachusetts	4	2	5	5	5	2	5	3	5	2	5	2
Wisconsin	7	7	7	9	8	10	8	11	6	11	6	11
Indiana	5	7	8	11	6	7	6	10	7	9	7	9

[1] No establishments reported in 1900.

Table 7 presents statistics of the manufacture of automobiles at the census of 1905 in cities having in 1900 a population of over 20,000.

TABLE 7.—SUMMARY FOR CITIES HAVING A POPULATION IN 1900 OF AT LEAST 20,000: 1905.

CITY.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
			Number.	Salaries.	Average number.	Wages.			
Total	86	$16,340,573	739	$859,302	8,081	$4,961,205	$3,389,442	$9,044,119	$21,075,073
Buffalo, N. Y.	5	790,853	53	70,859	625	389,505	179,562	579,604	1,385,509
Chicago, Ill.	7	376,886	15	26,180	145	99,433	61,591	103,740	324,710
Cleveland, Ohio	7	2,653,837	127	175,749	1,505	868,399	589,262	1,880,108	4,256,979
Detroit, Mich.	12	2,982,949	106	132,006	1,564	733,012	1,287,160	2,199,277	5,382,212
Indianapolis, Ind.	4	810,160	62	56,177	447	277,844	134,920	553,973	797,652
Kalamazoo, Mich.	3	96,471	9	7,828	48	28,019	10,874	29,564	72,959
New York, N. Y.	6	1,357,064	54	63,086	430	418,581	242,339	672,080	1,186,452
Reading, Pa.	3	367,694	19	11,968	164	91,428	19,948	132,617	269,464
All other cities[1]	39	6,904,659	294	315,449	3,153	2,054,984	863,786	2,893,156	7,399,136

[1] Includes establishments distributed as follows: Albany, N. Y., 1; Boston, Mass., 1; Bridgeport, Conn., 1; Cambridge, Mass., 1; Grand Rapids, Mich., 1; Hartford, Conn., 1; Hoboken, N. J., 1; Holyoke, Mass., 1; Jackson, Mich., 1; Los Angeles, Cal., 1; Milwaukee, Wis., 2; Minneapolis, Minn., 1; Newark, N. J., 1; New Britain, Conn., 1; New Haven, Conn., 1; Oshkosh, Wis., 1; Passaic, N. J., 1; Philadelphia, Pa., 1; Pittsburg, Pa., 1; Poughkeepsie, N. Y., 1; Providence, R. I., 2; Racine, Wis., 1; Rochester, N. Y., 1; St. Louis, Mo., 1; San Francisco, Cal., 2; San Jose, Cal., 2; Springfield, Mass., 1; Springfield, Ohio, 1; Syracuse, N. Y., 1; Taunton, Mass., 1; Toledo, Ohio, 2; Topeka, Kans., 1; Utica, N. Y., 1, Waltham, Mass., 1.

Of the total number of establishments in the United States Table 7 shows that 86, or 71.1 per cent, were located in cities of over 20,000 population. Of the totals for the country the capital invested in these establishments was 79.5 per cent; the number of salaried officials, etc., 77.5 per cent; the salaries paid, 79.8 per cent; the number of wage-earners, 78.9 per cent; the wages paid, 80.3 per cent; miscellaneous expenses, 85.9 per cent; cost of materials used, 77.6 per cent; and the value of products, 79.1 per cent. The average capital, cost of materials, and value of products, for the establishments located in the cities included in this table was $190,007, $105,164, and $245,059, respectively, as compared with $120,419, $74,686, and $159,143 for all automobile works located in the smaller cities, villages, and rural districts.

The prominence which Michigan holds in this industry is due, in large measure, to the establishments located in Detroit. The capital invested in this city alone was 14.5 per cent of the total for the United States; and the value of products 20.2 per cent of the total. The average capital invested per establishment in Detroit was $248,579, and the average value of products $448,518, compared with $379,120 and $608,140, the respective averages for establishments located in Cleveland, the second city in rank as to value of products. These two cities together were credited with more than one-third the total value of products for the entire country.

Contrasted with the compactness of the industry shown in the four leading centers—Detroit, Cleveland, Buffalo, and New York—is its wide dispersion among the 34 cities included in "all other cities." These scattered plants were located in 13 different states, as follows: Six plants in 6 different cities of Massachusetts; 5 in a like number of cities of New York; 5 in 3 cities of California; 4 in 4 cities of Connecticut; 4 in 3 cities of Wisconsin; 3 in 3 cities of New Jersey; 3 in 2 cities of Ohio; 2 in 2 cities in each of the states of Michigan and Pennsylvania; 2 in 1 city of Rhode Island; and 1 in each of the states of Kansas, Minnesota, and Missouri.

Table 8 is a comparative summary of the motive power used in 1900 and 1905.

TABLE 8.—*Power—comparative summary: 1905 and 1900.*

	1905	1900
Number of establishments reporting	113	51
Total horsepower	10,484	3,601
Owned:		
Engines—		
Steam—		
Number	53	33
Horsepower	5,565	2,610
Gas or gasoline—		
Number	59	13
Horsepower	1,149	130
Water wheels—		
Number	1	2
Horsepower	40	75
Electric motors—		
Number	96	32
Horsepower	2,860	437
Rented:		
Electric motors—		
Number	64	13
Horsepower	792	164
Other kind, horsepower	78	185
Furnished to other establishments, horsepower	25	7

A noteworthy fact shown by Table 8 is the marked increase in the average power used per establishment in 1905 over 1900. The 113 plants reporting in 1905 used an average of 92.8 horsepower per establishment, an increase of 22.2 horsepower over the average for 1900. In addition to the increased horsepower used, there was scarcely an establishment which had been in existence for three or four years that had not been enlarged.

AUTOMOBILES AS A MINOR PRODUCT.

The foregoing statistics pertain entirely to establishments engaged primarily in the production of au-

tomobiles, and therefore do not include 47 establishments engaged primarily in the manufacture of other products, but which during the census year 1905 turned out 1,138 automobiles, valued at $879,205. This amount has been included in the value of products of the several industries to which these plants belong. In 24 establishments classified under "carriages and wagons," 199 automobiles, valued at $235,675, were produced. In the industry "bicycles and tricycles" 6 establishments turned out 470 automobiles, valued at $314,554. Of these, 360 were runabouts and 110 touring cars. In "foundry and machine shop products" 13 establishments turned out 228 automobiles, valued at $190,700 and made up of 192 runabouts and 36 touring cars. Four establishments, 2 classified as "shipbuilding, wooden, including boat building," 1 as "sewing machines and attachments," and 1 as "carriage and wagon materials," reported 241 automobiles, valued at $138,276, manufactured as a minor product. Of these machines, 177 were runabouts and 64 touring cars. All these automobiles were propelled by gasoline, with the possible exception of those manufactured in carriage and wagon factories, for which the power was not reported.

ALLIED INDUSTRIES.

Automobile bodies and parts.—In considering the increase of the industry, it must be borne in mind that the entire work of manufacturing was not performed at the automobile factory. Certain parts were manufactured in establishments making a specialty of the component parts of the automobile, such as bodies, wheels, motors, lamps, and various articles of hardware. While some of the larger plants turn out all the parts, the smaller establishments, and by far the greater number, do not, but purchase more or less material in fully or partially manufactured form. In fact, there is a strong tendency in this direction, especially in the separate manufacture of the body of the automobile, as distinguished from the chassis or running gear. The Census classification for such establishments is "automobile bodies and parts." Although they enter into the statistics of the automobile industry proper only to the extent that their products constitute a portion of the cost of materials and miscellaneous expenses, they are really an integral part of that industry. In 1900 there was no separate classification of "automobile bodies and parts," therefore the general statistics for this industry are available only for the census of 1905.

A combination of the statistics for automobiles given in Table 1, and the figures given above for automobile bodies and parts, is exhibited in Table 9.

TABLE 9.—*Summary—automobiles and automobile bodies and parts: 1905.*

	Total.	Automobiles.	Automobile bodies and parts.
Number of establishments	178	121	57
Capital	$23,083,860	$20,555,247	$2,528,613
Salaried officials, clerks, etc	1,181	954	227
Salaries	$1,257,259	$1,076,425	$180,834
Average number of wage-earners	12,049	10,239	1,810
Total wages	$7,158,958	$6,178,950	$980,008
Miscellaneous expenses	$4,266,154	$3,946,369	$319,785
Cost of materials used	$13,151,365	$11,658,138	$1,493,227
Value of products	$30,033,536	$26,645,064	$3,388,472

Rubber and elastic goods.—Another industry which enters largely into automobile construction is the manufacture of rubber and elastic goods. A leading product of this industry is rubber tires, which form a very necessary element in automobile construction. The magnitude of the "rubber and elastic goods" industry in the United States, as well as its growth since 1900, is shown in Table 10.

TABLE 10.—*Rubber and elastic goods—comparative summary: 1905 and 1900.*

	1905	1900
Number of establishments	224	261
Capital invested	$46,297,537	$39,302,353
Average number of wage-earners	21,184	20,404
Total wages	$9,412,368	$8,081,803
Miscellaneous expenses	$6,516,272	$2,805,200
Cost of materials used	$38,912,226	$33,482,314
Value of products	$62,995,909	$52,621,830

Table 10 shows that during the five-year period there was an increase of $10,374,079 in the value of products of the rubber industry. A large part of this increase was caused not only by the enormous quantity of rubber used in the equipment of automobiles, but in the manufacture of various articles made necessary by their extensive use. Of the total increase, $8,633,499, or 83.2 per. cent, was reported by the single state of Ohio. Some establishments there located have doubled their product between 1900 and 1905, which is largely, and in some cases entirely, through the increasing demand for automobile tires.

IMPORTS AND EXPORTS.

Table 11 shows the value of exports of automobiles and automobile parts from the United States to foreign countries for each year since they have been separately reported.

TABLE 11.—*Value of exports of automobiles and automobile parts, for years ending June 30: 1902 to 1905.*[1]

EXPORTED TO—	1905	1904	1903	1902
Aggregate	$2,481,243	$1,895,605	$1,207,065	$948,528
Europe	1,428,411	1,020,681	853,437	796,108
Austria-Hungary	26,051	3,500	1,850	13,106
Belgium	38,220	22,971	3,670	7,797
Denmark	8,922	11,549	6,431	9,905
France	252,742	92,576	98,029	59,051
Germany	154,141	97,303	30,798	24,491
Greece	520	....	....	....
Italy	159,396	10,567	8,200	2,200
Netherlands	14,690	11,909	10,164	5,285
Norway	9,245	10,794	2,500	....
Portugal	3,784	1,904	12,904	....
Roumania	4,973	240	....	....
Russia on Baltic and White seas	59,243	64,981	813	1,023
Russia on Black sea	13,308	9,861	875	....
Spain	15,184	17,820	1,506	....
Sweden and Norway	....	....	....	1,697
Sweden	54,640	9,625	1,226	....
Switzerland	5,951	5,440	3,660	....
United Kingdom	607,401	649,641	670,811	671,553
North America	682,609	498,799	180,487	77,801
Bermuda	....	775	....	1,500
Dominion of Canada	441,425	330,952	136,586	37,439
Nova Scotia, New Brunswick, etc	18,647	16,359	2,916	1,500
Quebec, Ontario, Manitoba, etc	408,544	308,720	130,515	31,111
British Columbia	14,234	5,873	3,155	4,828
Newfoundland	7,300	997	2,025	....
Central America	1,810	38	21	....
Guatemala	[illegible]	....	21	....
Nicaragua	125	38	....	....
Panama	1,020	....	....	....
Salvador	65	....	....	....
Mexico	119,986	113,280	24,762	27,710
West Indies	112,088	52,757	17,093	11,152
British	14,982	5,758	4,948	....
Cuba	96,538	46,999	11,345	11,152
Dutch	50	....	....	....
French	[illegible]	....	800	....
Haiti	30	....	....	....
Santo Domingo	400	....	....	....
South America	81,368	35,106	24,557	15,353
Argentina	18,350	12,997	6,588	10,203
Brazil	4,010	2,346	6,900	2,150
Chile	5,659	1,693	....	....
Colombia	983	954	148	....
Ecuador	653	10,442	10,921	....
Guiana:				
British	450	....	....	....
Dutch	....	14	....	....
Peru	50,597	4,031	....	3,000
Venezuela	666	2,629	....	....
Asia	120,264	112,946	38,113	22,832
Chinese Empire	11,091	12,389	5,200	6,645
East Indies:				
British India	56,790	70,479	....	....
Straits Settlements	5,931	2,648	15,032	4,299
Other British	9,383	1,440	....	....
Dutch	20,169	2,335	2,544	1,200
Hongkong	815	780	1,600	1,175
Japan	13,438	22,875	13,737	9,513
Siam	1,782	....	....	....
Turkey in Asia	865	....	....	....
Oceania	101,464	168,382	51,163	23,797
British Australasia	98,562	164,130	48,078	9,581
French Oceania	1,200	....	....	....
Philippine Islands	1,702	4,252	3,085	14,216
Africa	67,127	59,691	59,308	12,637
British Africa—South	54,511	57,202	59,048	12,637
Canary Islands	....	....	260	....
French Africa	1,040	....	....	....
Portuguese Africa	679	654	....	....
Turkey in Africa—Egypt	10,897	1,835	....	....

[1] "Commerce and Navigation of the United States," Bureau of Statistics, Department of Commerce and Labor.

Table 11 shows the growing favor with which American-made automobiles are being received in foreign countries. The figures are also ample evidence that American manufacturers are fully alive to the advantage of extending their trade abroad. The number of cars exported is not available.

Europe has afforded the best market, though its percentage of the total purchases appears to be decreasing. During the years 1902 to 1905 this percentage was 83.9, 70.7, 53.8, and 57.6, respectively. However, the value of the exports to this grand division almost doubled in the three years. North America, whose purchases increased from $77,801 in 1902 to $682,609 in 1905, nearly eightfold, ranked second as a market for this class of American manufactures; and was followed by Asia, which showed an increase from $22,832 in 1902 to $120,264 in 1905, more than fourfold. In the three years Oceania increased its purchases from $23,797 to $101,464, or 326.4 per cent; South America, from $15,353 to $81,368, or 430 per cent; and Africa, from $12,637 to $67,127, or 431.2 per cent.

The great number of countries into which the American-made machine finds its way, some themselves foremost in the automobile industry, and some among the most remote in the world, will be a source of surprise to many readers.

Of the European countries, by far the greatest exportation has been to the United Kingdom, although during the three years there has been a small decrease of $64,152, or 9.6 per cent. Of the North American countries, the greatest exportation was to the Dominion of Canada, the purchases of which showed a gain of $403,986, or over tenfold, during the three years. Argentina and Peru in South America; British South Africa; and British India, Japan, and the Chinese Empire in Asia proved to be the best markets in their respective grand divisions.

Table 12, compiled from the Annual Reports of the Bureau of Statistics, Department of Commerce and Labor, shows the value of imports of automobiles and automobile parts for the fiscal years ending June 30, 1901 to 1905, together with the number, total value, and average value of the automobiles.

TABLE 12.—*Automobiles and automobile parts imported and entered for consumption during the fiscal years ending June 30: 1901 to 1905.*

YEAR.	Aggregate value.	AUTOMOBILES.			Automobile parts, value.
		Number.	Total value.	Average value.	
1901	$47,471	26	$43,126	$1,658.59	$4,345
1902	550,199	224	530,876	2,369.98	19,323
1903	1,009,001	317	963,998	3,041.00	45,003
1904	1,446,303	423	1,294,160	3,059.48	152,143
1905	2,433,507	653	2,297,104	3,517.77	136,403

Prior to the beginning of the fiscal year 1901 imports of automobiles were not enumerated separately. Since that time there has been a remarkable increase. This constant gain is due largely to the fact that the

majority of the automobiles imported are heavy, high-power touring cars, with multiple cylinder motors, in the construction of which foreign makers have gained preeminence. American designers have heretofore directed their efforts mainly toward the production of a light car equipped with horizontal motors, and in this type they have attained a higher efficiency than foreign makers. The work of the American and of the foreign manufacturers has thus been largely along different lines. However, the great advance being made by Americans in the manufacture of the touring car along the lines laid down by foreign makers indicates that conditions will assume a different aspect in the near future.

Not only the number and value of imports of automobiles have increased rapidly from year to year, but also the average value per machine has advanced steadily from $1,658.59 in 1901 to $3,517.77 in 1905, an increase of $1,859.18, or 112.1 per cent. This increase is not due to an advance in the price of imported vehicles, but to the importation of a higher grade of machines.

STATISTICAL SUMMARY.

Detailed statistics for the industry, as reported at the census of 1905, are shown in Table 13. This table presents totals for each of the 11 states which have three establishments or more engaged in manufacturing automobiles as a principal product, and combined totals for the 6 states having each less than 3 establishments. The components of the capital are shown, viz, amount invested in land; buildings; machinery, tools, and implements; and cash on hand and sundries. The salaried employees are classified into officers of corporations, and general superintendents, managers, clerks, etc., and wage-earners—men, women, and children—with the different amounts paid each class. The average number of men wage-earners employed during each month of the year is also given. Miscellaneous expenses, the cost of materials used, the value of products, and the kind and amount of power used are shown in detail.

HISTORICAL AND DESCRIPTIVE.

The modern automobile.—The early experimenters in motor vehicles were hampered by the lack of engines which used a fuel less heavy and bulky than coal. Light vehicle motors were made possible by the successful production of liquid or volatile fuels and the invention and perfection of the gas engine. The motive power in these gas or gasoline engines is furnished by a succession of explosions which take place within the cylinder itself, thereby doing away with the cumbersome boiler and furnace.

In 1886 it fell to the lot of two Germans, Gottlieb Daimler and Carl Benz, working independently, to apply the gas engine to road vehicles successfully. This revolutionized motor vehicle construction and occasioned its first great impetus. Daimler, who was manager of the Otto Gas Engine Works at Deutz, fitted his small air-cooled motor to a bicycle by placing it vertically between the front and rear wheels, the rear wheel being driven by means of a belt. In 1889 he constructed a two-cylinder engine, which attracted the attention of Messrs. Panhard and Levassor, of Paris, who acquired the necessary rights and immediately began the construction of the essentially modern motor car, the first of which was brought out in 1891.

Carl Benz first applied his single horizontal cylinder, water-jacketed engine to a three-wheel carriage. It was placed over the rear axle and drove a vertical crank shaft, thus giving the fly wheel a horizontal position. This arrangement insured stability in the steering of the car. The crank shaft was connected by bevel gearing to a short horizontal shaft, which was in turn coupled to a countershaft by a belt. The ends of this countershaft were connected to the road wheels by means of chains. Benz's engine was first worked on the two-stroke cycle, but in the subsequent development of the machine, in which he was assisted by Roger, of Paris, the Otto four-stroke cycle was used.

However, it must be remembered that during this earliest period in the evolution of the modern automobile the steam engine was advancing in efficiency and light construction to a degree equal to or greater than the gasoline engine. In Europe the most notable achievements along this line were those of Leon Serpollet, a Frenchman, who applied to road vehicles his instantaneous or "flash" generator, invented in 1889. The principle of this great invention consists in generating steam instantaneously by pumping water through flattened tubes of a very narrow section kept at a red heat by the furnace. The fuel used is vaporized oil.

The earliest attempts by American inventors to build horseless carriages were confined to steam motors. The omnibus built in 1878 by a Mr. Fawcett, of Pittsburg, employed a Brayton motor of unknown design. During the eighties a Mr. Copeland brought out a bicycle equipped with a steam motor, followed by two tricycles similarly equipped, which were the predecessors of the light steam vehicles. However, Copeland had to abandon his experiments through lack of capital.

The distinction of early experiments in this line is also claimed by a citizen of the state of Michigan in the person of Mr. R. E. Olds, who in 1886 began the construction of a horseless carriage. This vehicle, which was not completed until the following year, 1887,

was first fitted with a steam engine which was geared to the rear axle. The boiler was of the porcupine type and gasoline was used as the fuel. Later, this machine was remodeled, using a flash boiler, that is, the steam was generated only as required by the engines. In 1893 Mr. Olds began building gasoline motors for horseless carriages which, since their perfection in 1895, have proved practical and successful.

In 1886 Charles E. Duryea decided that the gasoline engine was best fitted to propel the horseless carriage. It was, however, not until 1892 that assisted by his brother, J. F. Duryea, he completed his first automobile. This machine proved to be decidedly underpowered and built of too light materials. Their next car, finished in 1893, embodied all the essential features of the modern automobile and was a success. The Duryea Motor Wagon Company was organized, and the 13 automobiles finished in the summer of 1896 were the first manufactured for sale in the United States. The price of these vehicles, $1,500, was considered very high for an untried substitute for the horse and carriage and prevented the immediate acceptance of the gasoline automobile in America. A large majority of the plants reported for the industry at the census of 1900 commenced operation in 1899, the date of the substantial beginning of the automobile movement in America.

Steam motors.—The principal parts of the steam motor are the boiler and engine. Two types of tubular boilers are used, the water tube and fire tube, according to whether the tubes are to contain fire or water. The Serpollet boiler, used almost universally in European steam vehicles, is of the water-tube variety, while American builders use the fire-tube type to a great extent. The common boiler used in American steam machines is a cylindrical upright steel shell, through which pass vertical copper or steel fire tubes, from 300 to 350 in number.

The invention of the instantaneous generator, known by the name of the inventor, Leon Serpollet, in 1889, gave the first real impulse to modern steam carriage building. It consisted of a coil of 1½-inch lap-welded steel tubing flattened, in the earliest type, until the bore was of almost capillary width, but later to a width of about one-eighth of an inch. The coil was surrounded by a cast-iron covering to protect the steel from corrosion by heat. The water, upon being injected into the heated tube, was vaporized almost instantly. Two coils connected in series were later used, and finally a train of coils and bent tubing.

The engine used with the Serpollet boiler has four single-acting cylinders arranged in pairs. They may be set either obliquely, so as to make an angle of 45 degrees with each other at the crank shaft, or horizontally on opposite sides of the crank shaft. A countershaft is used, parallel to the rear axle, connected with the crank shaft by chain, and to the driving axle by gearing.

The engine most commonly used on the lighter vehicles by American manufacturers is double-cylindered, double acting, and set vertically. The diameter of the cylinder varies from 2½ to 3 inches, and the stroke from 3 to 3½ inches. The power is transmitted usually direct from the engine shaft to the rear driving axle by chain, but in a few cases the countershaft is used. The fuel used is some form of mineral oil, usually gasoline, or alcohol, which is vaporized by the use of special burners. Compressed air, supplied by either a hand pump or a power pump operated by the moving parts of the engine, affords a pressure for feeding the oil to the burners. Automatic feed pumps, operated by the engine, supply water to the boilers.

Petrol motors.—In 1882 M. Beau de Rochas, a French engineer, patented an internal-combustion engine. The principles of this invention have ever since afforded the basis for designers of this class of engine. The simplest form consists of a single cylinder closed at the top and open at the bottom, within which moves a closely fitting piston, connected by a swinging rod to the crank shaft. A mixture of air and the vaporized spirit is introduced into the cylinder when the piston is at the top, forming a cushion between the fixed top of the cylinder and the movable piston. The mixture is then ignited, causing an explosion. The piston, which is fitted gas tight, is the only thing that can give way, and is driven to the bottom of the cylinder, where its further downward movement is arrested by the crank. The impulse of this explosive stroke is stored in a fly wheel attached to the crank shaft, which is carried round again, driving the piston up.

The mechanism described is the two-stroke cycle, sometimes called the "two-cycle engine." The chief claim for this type of engine is its undoubted simplicity. The absence of valves, gears, cams, and springs makes it cheap to manufacture and repair. Although theoretically it would appear to be adapted to the automobile, since the gain in power over a four-cycle engine of the same size exceeds 60 per cent, it has thus far proved unavailable.

The four-cycle engine, more commonly called the "Otto cycle," from Dr. N. A. Otto, the first to make practical use of it, is now almost universally used for the automobile. In this engine there is only one explosion to four strokes of the piston. These are termed, respectively, the suction stroke, to draw into the cylinder the mixture of air and vaporized spirit; the compression stroke; the explosion stroke, following the ignition of the vapor; and the exhaust stroke, to drive out the gases of combustion. It is estimated that an engine of this character is capable of 1,200 to 1,500 revolutions per minute, while a two-cycle engine

of the same power can make no more than 300 to 350 revolutions. The description given is of a single-cylinder engine. Automobiles are variously equipped with one, two, four, six, and eight cylinder motors. Three-cylinder motors have also been tried but to a very limited extent.

The other main parts of the gasoline motor are the carburetor or vaporizer, in which the liquid hydrocarbon is transformed into vapor, and the ignition apparatus, which produces the spark or hot surface essential to explosion. There are two general types of carburetors—surface carburetors that operate by evaporation, and float-feed carburetors or sprayers. At the present time the surface carburetor is little used, except for motor cycles. There are also several methods of ignition, among which may be mentioned the gas jet and hot tube of the Otto engines, the hot head of the Hornsby-Akroyd motor, the hot wall of the Diesel motor, and the electric spark. The Daimler type of carriage motor still retains the hot-tube ignition, while most other types use the electric spark.

On account of the great heat developed in the cylinder of a gasoline motor some means of cooling sufficiently to avert premature explosion and permit of proper lubrication must be employed. The two systems in general use are the air cooling, limited to engines of small dimensions, and the water cooling.

The early motors were practically all air cooled. American inventors first designed successful air cooling systems. The most successful means at present employed to air-cool cylinders is a rotary fan on the main shaft which creates a forced draft through an air jacket surrounding the cylinder, to the outside surface of which fins or flanges are attached, or a large number of brass pins are secured in holes on the outside of the cylinder's wall. The water cooling system, however, by which a constant circulation of water around the cylinder is maintained through the use of a water jacket, is far more generally used.

Like the steam motor, the gasoline motor transmits its power to a crank shaft from which it is conveyed to the driving shaft by a chain or gearing. The motor is generally started by rotating the crank shaft by a lever attached to one end, although several methods are in use by which the engine is automatically started.

In the United States gasoline has been used almost exclusively for automobile internal-combustion motors, although benzine and alcohol are most used in Germany. A law removing the internal revenue tax on denatured alcohol may open the door for a great advance in the automobile industry in the United States by substituting alcohol for gasoline. The importance of this measure may be realized when it is known that the supply of gasoline is limited, as petroleum yields only 2 per cent of gasoline; whereas the sources from which alcohol can be produced are inexhaustible. Alcohol is better and safer than gasoline and also free from unpleasant odors. A recent experiment with a six-cylinder car demonstrated that with the same amounts of gasoline and alcohol, the former developed 52 horsepower, and the latter 60.

Electric motors.—The electric motor for use on the automobile is in a less advanced state of development than either the steam or gasoline motor. The only practical supply of power is by means of heavy storage batteries carried on the car itself. The full capacity of the average storage battery will not carry an automobile more than 40 or 50 miles. If the electricity gives out at any place other than an electric charging station, the machine is helpless. Electrical engineers are working toward a more satisfactory storage battery, which when perfected will undoubtedly make the electric automobile the ideal type, as the mechanism is the simplest and least liable to get out of order. The most notable extension of the use of electric automobiles has been in the industrial field. During the past five years large numbers of electric drays, trucks, delivery wagons, etc., have been built.

The storage battery for supplying the current, the motor for transforming this current into mechanical power, and the controller for regulating the speed of the motor constitute the principal equipment of the electric automobile. The current passes from the storage battery into the motor or reversed dynamo, which drives the rear wheels through proper gearing. When two motors are used no transmission shaft or gearing is necessary. A number of fairly successful vehicles have been introduced in which a hydrocarbon engine drives a dynamo-electric generator which in turn furnishes current to the storage batteries and motor; in some instances the dynamo, being reversible, is also made to play the part of a motor.

Frame, wheels, and body.—In making the frame the ends sought by the automobile manufacturer are lightness and strength. Steel tubing was formerly considered almost essential to secure this desired combination, but experience has proven that the reduction in weight is more than offset by the greater complexity of structure, the present tendency being toward the use of pressed steel.

The wheels of self-propelled vehicles must possess great strength and elasticity. The automobile requires a wheel about eighteen times as strong as the ordinary horse-drawn vehicle, since it carries a load over twice as heavy at a speed over three times as great. Wire wheels, which sustain a heavier load than wooden wheels in proportion to their weight, were first used, but they will not stand so great a side thrust and have therefore been practically superseded by the modern type of artillery wheel. Strength is gained by using a wheel of much smaller diameter than those used on

45254—MFG 1905—PT 4—08——20

horse-drawn vehicles. Heavy tires are necessary to secure efficient traction and the elasticity needed to counteract the vibration caused by the machinery and the irregular roadways.

The present automobile body is a development of the ordinary carriage body. In the pioneer days of the horseless carriage, makers naturally adopted buggy and carriage bodies, as their attention was devoted almost exclusively to the operation of the engine. As the machinery began to work more satisfactorily it was realized that the carriage body was in the way, and the designer was called upon for a body more suitable for an automobile. As the carriage builder was experienced in body making and best equipped for it, the body is now commonly manufactured in a separate establishment from the running gear. The development of the body has kept pace with that of the running gear. American designers have improved upon their French models until now the best American automobile bodies are unexcelled. The separate manufacture of body and running gear has led to the common custom of purchasing the chassis from the automobile maker and the body from some firm engaged in that particular branch of manufacture.

In the manufacture of automobile bodies hickory and cypress are used to some extent, but ash from Michigan, Wisconsin, Indiana, and Ohio, and poplar from Indian Territory and Georgia find most favor. The ash is used for the frame and the poplar for the panels and the top.

The horsepower of the motors used for commercial and pleasure purposes ranges from about 5 to 100. The remarkable progress made by the automobile as a purely speed machine has been furthered by the various tests of speed and endurance arranged largely as a means of recreation. The racing car, with over 100 horsepower crowded into a vehicle weighing 2,000 pounds, has attained a speed of more than 2 miles a minute on specially prepared and peculiarly suitable roads. Even up steep grades nearly 80 miles an hour has been made. In speed the touring car holds a position next to the racing car, as 60 miles an hour can be covered with ease.

Though not yet perfected, the automobile has become at least reliable. Models and parts are being standardized, thus rendering it possible to replace broken or worn out parts without delay. In the United States many express and transfer companies, department stores, and fire departments have abandoned the horse-drawn vehicle for the automobile. In New Mexico it has supplanted the stage coach between Roswell and Torrance, a distance of 101 miles. It has worked a revolution in Nevada, where the means of local transportation have heretofore been confined to the mule. Liverymen acknowledge the passing of the horse by operating automobiles in connection with their stables. In many of the larger cities the automobile has been introduced for public transportation. Although it is as yet unsuited for general transportation in the field, yet the utility and advisability of the self-propelled vehicle for military purposes have been amply demonstrated. In Germany armored automobiles are being constructed for use in the army.

In the United States the use of automobiles will be limited only by their cost and the condition of the highways. The cost is gradually becoming less and the automobile itself is already felt as a factor in the movement for good roads.[1]

[1] In the preparation of the foregoing historical and descriptive sketch the following authorities have been consulted: The Complete Motorist, Young; The Book of the Automobile, Sloss; Self-Propelled Vehicles, Homans; Petrol Motors and Motor Cars, White; Modern Steam Road Wagons, Norris; various publications of The Motor Way; article "Automobiles" in International Encyclopedia.

TABLE 13.—AUTOMOBILES—DETAILED

		United States.	California.	Connecticut.
1	Number of establishments	121	6	7
	Capital:			
2	Total	$20,555,247	$48,802	$3,712,922
3	Land	$951,910	$500	$138,324
4	Buildings	$2,720,760	$800	$770,987
5	Machinery, tools, and implements	$4,290,831	$28,800	$851,477
6	Cash and sundries	$12,591,746	$18,702	$1,952,134
7	Proprietors and firm members	53	4	4
	Salaried officials, clerks, etc.:			
8	Total number	954	3	62
9	Total salaries	$1,076,425	$4,800	$86,372
	Officers of corporations—			
10	Number	114	...	9
11	Salaries	$286,557	...	$34,500
	General superintendents, managers, clerks, etc.—			
12	Total number	840	3	53
13	Total salaries	$789,868	$4,800	$51,872
	Men—			
14	Number	661	3	42
15	Salaries	$703,441	$4,800	$46,560
	Women—			
16	Number	179	...	11
17	Salaries	$86,427	...	$5,312
	Wage-earners, including pieceworkers, and total wages:			
18	Greatest number employed at any one time during the year	14,585	24	1,475
19	Least number employed at any one time during the year	6,333	13	808
20	Average number	10,239	14	1,065
21	Total wages	$6,178,950	$10,124	$783,993
	Men 16 years and over—			
22	Average number	10,196	14	1,057
23	Wages	$6,167,345	$10,124	$781,604
	Women 16 years and over—			
24	Average number	11	...	...
25	Wages	$3,689	...	...
	Children under 16 years—			
26	Average number	32	...	8
27	Wages	$7,916	...	$2,389
	Average number of wage-earners, including pieceworkers, employed during each month:[2]			
	Men 16 years and over—			
28	January	9,133	20	902
29	February	9,973	18	963
30	March	11,272	14	1,081
31	April	12,405	13	1,237
32	May	12,531	13	1,258
33	June	12,562	12	1,342
34	July	10,770	15	1,255
35	August	8,881	13	1,029
36	September	8,155	13	671
37	October	8,254	12	706
38	November	8,776	12	1,074
39	December	9,640	13	1,166
	Miscellaneous expenses:			
40	Total	$3,946,369	$10,139	$466,851
41	Rent of works	$88,497	$3,420	$1,945
42	Taxes	$77,625	$257	$11,843
43	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$2,745,601	$6,462	$453,063
44	Contract work	$1,034,646	...	...
	Materials used:			
45	Total cost	$11,658,138	$12,863	$1,163,072
46	Principal materials	$9,507,503	$10,104	$600,184
47	Fuel	$180,092	$199	$28,328
48	Rent of power and heat	$35,387	$550	$640
49	Mill supplies	$133,589	$85	$8,734
50	All other materials	$1,609,806	$1,900	$498,279
51	Freight	$191,761	$25	$26,907
	Products:			
52	Aggregate value	$26,645,064	$36,380	$2,644,334
	Automobiles—			
53	Total number	21,692	12	832
54	Total value	$23,751,234	$13,606	$1,958,682
	Touring—			
55	Number	7,220	1	292
56	Value	$11,781,521	$1,800	$1,008,383
	Runabout—			
57	Number	12,131	6	209
58	Value	$8,831,504	$5,156	$283,800
	Stanhope—			
59	Number	520	...	106
60	Value	$614,104	...	$61,637
	Delivery, heavy—			
61	Number	160	1	23
62	Value	$491,490	$3,000	$91,000
	Delivery, light—			
63	Number	251	3	...
64	Value	$455,457	$3,150	...
	Surrey—			
65	Number	221	...	38
66	Value	$229,872	...	$45,462
	Victoria—			
67	Number	66	...	...
68	Value	$77,740	...	...
	Phaeton—			
69	Number	49	...	...
70	Value	$69,450	...	...
	Doctor's wagon or car—			
71	Number	54	1	...
72	Value	$47,140	$500	...

[1] Includes establishments distributed as follows: Kansas, 1; Maine, 1; Minnesota, 1; Missouri, 1; New Hampshire, 1; Rhode Island, 2.

SUMMARY, BY STATES: 1905.

Illinois.	Indiana.	Massachusetts.	Michigan.	New Jersey.	New York.	Ohio.	Pennsylvania.	Wisconsin.	All other states.[1]	
8	8	11	22	5	21	14	6	6	7	1
$378,536	$1,140,509	$1,623,857	$3,765,240	$310,261	$3,172,531	$3,544,162	$1,452,963	$1,240,006	$165,458	2
$2,500	$67,500	$73,141	$173,977	...	$275,018	$83,050	$65,600	$67,300	$5,000	3
$3,000	$167,871	$199,048	$361,634	...	$369,275	$518,952	$231,129	$86,644	$11,420	4
$209,654	$309,125	$352,773	$544,560	$51,874	$791,534	$751,304	$194,204	$161,727	$43,799	5
$163,382	$596,013	$998,895	$2,685,069	$258,387	$1,736,704	$2,190,856	$962,030	$924,335	$105,239	6
4	4	4	9	1	7	3	...	8	5	7
15	94	98	151	22	200	172	65	59	13	8
$26,180	$74,293	$115,832	$188,452	$13,662	$202,869	$218,950	$78,681	$54,180	$12,154	9
8	5	16	15	2	24	23	6	2	4	10
$18,500	$12,300	$40,384	$31,020	$2,000	$62,559	$52,505	$20,789	$6,000	$6,000	11
7	89	82	136	20	176	149	59	57	9	12
$7,680	$61,993	$75,448	$157,432	$11,662	$140,310	$166,445	$57,892	$48,180	$6,154	13
6	68	61	96	19	138	120	53	49	5	14
$7,200	$53,721	$64,887	$133,914	$11,246	$124,338	$151,877	$56,128	$44,124	$4,646	15
1	21	21	40	1	38	29	6	8	3	16
$480	$8,272	$10,561	$23,518	$416	$15,972	$14,568	$1,764	$4,056	$1,508	17
172	973	1,448	3,064	115	2,468	3,215	717	799	115	18
123	511	495	1,474	57	721	1,436	377	224	94	19
146	789	952	2,123	60	1,624	2,277	566	520	103	20
$100,433	$482,198	$596,277	$970,895	$40,296	$1,095,470	$1,368,810	$352,482	$299,624	$78,348	21
146	784	944	2,122	59	1,618	2,272	566	511	103	22
$100,433	$480,456	$594,082	$970,770	$40,248	$1,094,120	$1,367,160	$352,482	$297,518	$78,348	23
...	3	1	1	...	1	5	...	...	...	24
...	$1,326	$300	$125	...	$288	$1,650	...	...	...	25
...	2	7	...	1	5	...	...	9	...	26
...	$416	$1,895	...	$48	$1,062	...	...	$2,106	...	27
142	750	854	1,726	39	1,457	2,215	435	493	100	28
143	818	1,042	1,921	41	1,378	2,517	446	584	102	29
145	864	1,269	2,215	42	1,657	2,704	534	646	101	30
152	869	1,357	2,661	47	1,831	2,838	602	696	102	31
154	881	1,187	2,870	49	1,667	2,968	628	754	102	32
154	895	1,073	2,948	48	1,780	2,771	666	770	103	33
160	858	967	2,264	69	1,311	2,385	668	711	107	34
159	701	802	1,846	85	1,376	1,786	602	374	108	35
140	642	705	1,737	68	1,446	1,794	547	289	103	36
139	616	646	1,720	71	1,676	1,840	502	228	98	37
135	694	667	1,749	76	1,820	1,641	544	259	105	38
129	820	759	1,807	73	2,017	1,805	618	328	105	39
$61,721	$230,226	$228,504	$1,423,167	$40,459	$565,776	$677,374	$61,795	$163,995	$16,362	40
$8,701	$3,592	$6,397	$12,805	$3,776	$36,838	$4,281	$2,118	$580	$4,044	41
$1,297	$5,547	$9,591	$9,365	$950	$7,793	$20,034	$1,160	$9,192	$596	42
$51,723	$221,087	$212,016	$370,035	$35,733	$520,895	$652,637	$58,517	$154,223	$9,210	43
...	...	$500	$1,030,962	...	$250	$422	...	...	$2,512	44
$104,390	$811,823	$1,047,488	$2,872,655	$43,905	$1,764,567	$2,298,651	$601,430	$845,348	$91,946	45
$95,335	$625,262	$865,370	$2,586,395	$29,931	$1,459,265	$1,985,047	$383,346	$796,681	$70,583	46
$1,535	$18,523	$20,573	$21,177	$3,074	$27,892	$42,815	$7,732	$6,447	$1,797	47
$3,380	$1,157	$3,420	$3,330	$1,462	$14,486	$3,648	$2,924	...	$390	48
$135	$20,276	$11,988	$30,517	$612	$5,293	$46,766	$7,624	$945	$614	49
$3,620	$128,535	$126,871	$163,814	$8,299	$250,831	$195,761	$187,314	$27,400	$17,182	50
$385	$18,070	$19,266	$67,422	$527	$6,800	$24,614	$12,490	$13,875	$1,380	51
$327,710	$1,595,302	$2,160,455	$6,876,708	$118,753	$3,791,956	$5,788,563	$1,225,678	$1,875,259	$203,966	52
205	1,020	2,365	9,125	51	1,808	2,808	963	2,390	113	53
$262,691	$1,428,463	$2,052,943	$6,552,804	$71,400	$3,071,093	$5,197,360	$1,134,776	$1,856,694	$150,722	54
52	387	361	2,561	[3]3	397	2,521	576	20	49	55
$75,838	$736,869	$692,439	$2,402,125	$8,000	$995,982	$4,967,731	$798,972	$20,000	$73,382	56
54	230	1,153	6,432	32	1,082	186	330	2,358	59	57
$35,800	$173,084	$816,844	$4,057,439	$34,500	$1;163,554	$124,629	$247,204	$1,826,294	$63,200	58
46	231	...	...	...	36	100	1	...	...	59
$69,097	$326,370	...	...	...	$55,500	$100,000	$1,500	...	...	60
...	...	...	51	1	81	1	...	2	...	61
...	...	...	$36,390	$3,000	$349,500	$5,000	...	$3,600	...	62
...	18	73	51	15	77	...	1	10	3	63
...	$20,160	$164,600	$35,250	$25,900	$191,457	...	$2,000	$6,800	$6,140	64
...	24	105	30	...	22	...	2	...	...	65
...	$28,800	$109,860	$21,600	...	$20,600	...	$3,550	...	...	66
...	64	...	...	...	2	...	...	...	...	67
...	$74,240	...	...	...	$3,500	...	...	...	...	68
1	...	...	...	...	...	...	48	...	...	69
$1,200	...	...	...	...	...	...	$68,250	...	...	70
...	53	...	...	...	...	...	...	...	...	71
...	$46,640	...	...	...	...	...	...	...	...	72

[2] The average number of women 16 years and over and children under 16 years, employed during each month, are not included in the table, because of the small number reported.

TABLE 13.—AUTOMOBILES—DETAILED

		United States.	California.	Connecticut.
	Products—Continued.			
	Automobiles—Continued.			
	Station wagon or car—			
73	Number	13		
74	Value	$25,800		
	Other varieties—			
75	Number	1,007		164
76	Value	$1,127,156		$468,400
77	All other products, including parts	$2,042,777	$1,761	$331,253
78	Amount received for custom work and repairing	$851,053	$21,013	$354,399
	Motive power:			
79	Total number of machines	21,692	12	832
80	Gasoline, number	18,699	12	386
81	Electric, number	1,425		319
82	Steam, number	1,568		127
	Power:			
83	Number of establishments reporting	113	5	6
84	Total horsepower	10,484	32	1,822
	Owned—			
	Engines—			
	Steam—			
85	Number	[illegible]		7
86	Horsepower	5,565		1,245
	Gas or gasoline—			
87	Number	59	2	1
88	Horsepower	1,149	18	3
	Water wheels—			
89	Number	1		
90	Horsepower	40		
	Electric motors—			
91	Number	96		17
92	Horsepower	2,860		539
	Rented—			
	Electric motors—			
93	Number	64	3	1
94	Horsepower	792	14	15
95	Other kind, horsepower	78		20
96	Furnished to other establishments, horsepower	25		

SUMMARY, BY STATES: 1905—Continued.

Illinois.	Indiana.	Massachusetts.	Michigan.	New Jersey.	New York.	Ohio.	Pennsylvania.	Wisconsin.	All other states.	
....	11	....	....	....	2	....	....	....	....	73
....	$19,800	....	....	....	$6,000	....	....	....	....	74
52	2	673	....	....	109	....	5	....	2	75
$80,756	$2,500	$269,200	....	....	$285,000	....	$13,300	....	$8,000	76
$23,290	$114,963	$78,907	$276,680	$36,050	$494,608	$554,642	$83,183	$16,080	$31,360	77
$41,729	$51,876	$28,605	$47,224	$11,303	$226,255	$36,561	$7,719	$2,485	$21,884	78
205	1,020	2,365	9,125	51	1,808	2,808	963	2,390	113	79
66	595	1,765	9,114	6	1,496	1,811	955	2,388	105	80
139	424	....	11	15	307	200	8	2	....	81
....	1	600	....	30	5	797	....	....	8	82
7	7	10	22	5	20	14	6	6	5	83
114	1,050	616	1,511	232	1,228	2,550	568	645	116	84
....	4	6	7	4	7	11	5	2	....	85
....	525	437	758	165	575	1,040	320	500	....	86
1	6	3	15	2	9	4	3	7	3	87
36	137	41	390	14	113	86	103	145	63	88
....	....	....	....	....	....	....	....	....	1	89
....	....	....	....	....	....	....	....	....	40	90
3	23	1	8	....	17	21	6	....	....	91
23	378	10	266	....	192	1,307	145	....	....	92
5	1	13	10	8	15	7	....	....	1	93
55	10	122	90	53	343	80	....	....	10	94
....	....	6	7	....	5	37	....	....	3	95
....	....	5	....	....	....	....	....	....	20	96

BICYCLES AND TRICYCLES

BICYCLES AND TRICYCLES.

By Robert H. Merriam.

The statistics for the 101 establishments that were engaged primarily in manufacturing bicycles and tricycles at the census of 1905, and those for similar establishments for the censuses of 1890 and 1900, are summarized in Table 1.

Table 1.—*Comparative summary, with per cent of increase and decrease: 1890 to 1905.*

	Census. 1905[1]	Census. 1900	Census. 1890	Per cent of decrease, 1900 to 1905.	Per cent of increase, 1890 to 1900.
Number of establishments	101	312	27	67.6	1,055.6
Capital	$5,883,458	$29,783,659	$2,058,072	80.2	1,347.2
Salaried officials, clerks, etc., number	361	2,034	[2] 128	82.3	1,489.1
Salaries	$350,798	$1,753,235	[2] $123,714	80.0	1,317.2
Wage-earners, average number	3,319	17,525	1,797	81.1	875.2
Total wages	$1,971,403	$8,189,817	$982,014	75.9	734.0
Men 16 years and over	3,298	16,700	1,747	80.3	855.9
Wages	$1,964,940	$7,952,257	$971,539	75.3	718.5
Women 16 years and over	7	517	15	98.6	3,346.7
Wages	$3,481	$175,028	$3,729	98.0	4,593.7
Children under 16 years	14	308	35	95.5	780.0
Wages	$2,982	$62,532	$6,746	95.2	826.9
Miscellaneous expenses	$574,655	$2,252,604	$242,018	74.5	830.8
Cost of materials used	$2,628,146	$16,792,051	$718,848	84.3	2,236.0
Value of products	$5,153,240	$31,915,908	$2,568,326	83.9	1,142.7

[1] Exclusive of the statistics of 13 establishments making bicycles and tricycles, and bicycle parts, but engaged primarily in the manufacture of other products. The value of bicycles and tricycles, and bicycle parts made in such establishments was $575,959.

[2] Includes proprietors and firm members with their salaries; number only reported in 1900 and 1905, but not included in this table.

The most noticeable feature in this industry, as shown by the figures in Table 1, is its rapid growth and decline within fifteen years. The establishments engaged primarily in manufacturing bicycles and tricycles numbered only 27 in 1890, while in 1900 they numbered 312, and at the present census only 101. The decrease is also noticeable in the average number of wage-earners employed, and in the value of the products. The average number of wage-earners decreased from 17,525 in 1900 to 3,319 in 1905, which was only 1,522 more than were employed in 1890, and the value of products decreased from $31,915,908 in 1900 to $5,153,240 in 1905.

Prior to the decade ending in 1880, the manufacture of bicycles was intermittent, and it was not until 1890 that the industry was of sufficient importance in the United States to be reported separately. Up to that time the statistics relating to this industry were included in those for carriages and wagons. During the decade ending in 1900 the progress made was most remarkable, the climax being reached about the middle of that period.

With the general adoption of the pneumatic tire and society's approval of cycling, came the prosperous days of 1894 to 1896. People went cycle mad; the bicycle industry appeared to be an Eldorado, and there was a rush to engage in it. Then followed the decline in popularity, with the resultant dull times and failures among the manufacturers. By 1898, however, the industry was being conducted upon sound economic principles.

When the demand for bicycles decreased some manufacturers turned to the automobile, and many establishments that made only bicycles in 1900 are now devoted primarily to the manufacture of automobiles, while others make them to a greater or less degree in connection with the manufacture of bicycles. As far as reported to this Bureau, the value of automobiles and automobile parts reported at the census of 1905 by establishments devoted primarily to the manufacture of bicycles and tricycles was $345,179.

Production.—Table 2 is a detailed statement, for the United States, of the number and value of the different kinds of products made in all establishments making bicycles and tricycles and bicycle parts during the census years 1900 and 1905.

Table 2.—*Number and value of different kinds of products, including those produced as secondary products: 1905 and 1900.*

	1905 Number.	1905 Value.	1905 Average value.	1900 Number.	1900 Value.	1900 Average value.
Total	256,986	$5,729,199	....	1,208,960	$33,469,085	....
Bicycles	252,923	4,109,429	$16.25	1,182,850	23,689,437	$20.03
Individual—						
Chainless	4,077	142,136	34.86	42,929	1,957,329	45.59
Chain	246,304	3,594,504	14.59	1,136,122	21,488,589	18.91
Tandem	106	4,283	66.02	3,640	210,569	57.85
Motor	2,436	368,506	154.25	159	32,950	207.23
Tricycles	4,063	33,560	8.26	26,110	71,985	2.76
Custom work and repairing	....	296,344	....	....	(1)	....
All other products	....	[2] 1,289,866	....	....	9,707,663	....

[1] This item, reported under the classification "bicycle and tricycle repairing," amounted to $13,766,033.

[2] Includes value of automobiles and automobile and bicycle parts, etc.

In addition to the 101 establishments shown in Table 1, there were 13 factories engaged primarily in some other branch of manufacture, which made, during the census year 1905, 25,319 bicycles and tricycles, valued at $551,794; manufactured bicycle parts to the value of $16,540; and did custom and repair work to the value of $7,625. The figures for these 13 establishments are included in Table 2.

The 101 establishments engaged primarily in the manufacture of cycles made 231,667 bicycles and tricycles, valued at $3,591,195; bicycle parts, valued at $933,147; and did custom and repair work to the amount of $288,719. The total value of all products, as shown in Table 2, is $5,729,199. In the item "all other products" is included $345,179, the value of automobiles and automobile parts manufactured by bicycle and tricycle establishments, while the value of chains, spokes, handle bars, saddles, rims, and other parts manufactured make up the greater part of the remaining $944,687.

At the census of 1900 the total number of bicycles reported was 1,182,850, while in 1905 only 252,923 were reported, a decrease of 929,927. It is probable this decrease was much larger than is shown in Table 2, for the reason that in 1900 there were 6,328 establishments classified as bicycle and tricycle repair shops, which undoubtedly manufactured a considerable number of bicycles. As detailed reports were not received from these repair establishments, an estimate of the number of wheels they made would be of little value. The gross value of the product of these shops in 1900, however, was $13,766,033.

The average value of a chain bicycle was $14.59 in 1905 as compared with $18.91 in 1900. This is for a "stripped" wheel at the factory, as the majority of the manufacturers reported stripped and not completely equipped wheels. This explanation also applies to chainless wheels, whose average value at the factory in 1905 was $34.86, while in 1900 it was $45.59. The decrease in price per wheel between the two census periods is but a continuation of the downward trend which first began in 1894, when the price of a complete wheel fell from $150 to $125. In the following year another $25 was deducted, and in spite of the prosperous season of 1895–96 the price continued to fall until it reached the present level of from $35 to $50 for a chain bicycle.

The only kind of machine referred to in Table 2, which shows an increase over 1900, is the motor cycle. In 1900 there were reported 159 motor cycles, valued at $32,950, while at the present census 2,436 are reported, valued at $368,506. The motor cycle had received scant attention during the low ebb in cycling, owing to the general attention being directed toward low-priced machines and the apparently large profits to be made in manufacturing automobiles. Slowly, however, the motor cycle won its way toward recognition, and, one after another, the bicycle establishments took up its manufacture. At the present census 28 establishments are making motor cycles.

Most of the tricycles reported were children's toys, which accounts for the low price.

Table 3 is a comparative summary, by states, of the bicycle and tricycle industry for the censuses of 1890, 1900, and 1905, the table also shows the increases and decreases.

TABLE 3.—*Comparative summary—active establishments, by states, with increase and decrease: 1890 to 1905.*[1]

STATE.	CENSUS.			Decrease, 1900 to 1905.	Increase, 1890 to 1900.
	1905	1900	1890		
United States	101	312	27	211	285
California	4	4			4
Colorado	2	1		[2] 1	1
Connecticut	2	24	2	22	22
Illinois	13	60	5	47	55
Indiana	2	19	1	17	18
Iowa		1		1	1
Kentucky		1		1	1
Maine		1		1	1
Maryland	1	1			1
Massachusetts	8	25	7	17	18
Michigan	4	11	1	7	10
Minnesota	8	4		[2] 4	4
Missouri	2			[2] 2	
Nevada		1		1	1
New Hampshire		1		1	1
New Jersey	3	7	1	4	6
New York	32	66	4	34	62
North Carolina	1			[2] 1	
Ohio	3	34	2	31	32
Oregon			1		[3] 1
Pennsylvania	12	24	3	12	21
Rhode Island	1	4		3	4
Wisconsin	3	23		20	23

[1] Does not include establishments producing bicycles and tricycles as secondary products.
[2] Increase.
[3] Decrease.

In but 4 states did the industry show an increase in 1905 over 1900, and in 2 of these—Missouri and North Carolina—no establishments were reported in 1900, while in 1905 there were only 2 and 1, respectively. The other states showing an increase were Colorado and Minnesota, in which there were no bicycle and tricycle factories in 1890. California and Maryland had the same number of factories in 1905 as in 1900. Iowa, Kentucky, Maine, Nevada, and New Hampshire each having 1 establishment in 1900 had no plants in 1905. The remaining states which reported establishments in 1900 show a large decrease at the present census. This is particularly noticeable in Connecticut, Illinois, Indiana, Massachusetts, New York, Ohio, Pennsylvania, and Wisconsin.

In 1890 there were only 27 establishments reported which were distributed among 10 states; in 1900, 312 establishments were reported from 20 states, and in 1905 there were 101 factories reported from 17 states. Connecticut, Illinois, Indiana, Massachusetts, Michigan, New Jersey, New York, Ohio, and Pennsylvania have reported active establishments in this industry ever since it was first reported separately. Oregon is the only state named in the table which has reported no active establishments since 1890.

Of the 101 establishments reported at the present census 40 reported in 1900, while 61 are either new

concerns started since 1900, or, in some cases, possibly reorganizations, under different names, of firms active in 1900. As far as ascertained 236 of the bicycle and tricycle plants which reported at the census of 1900 have since then gone out of business, while 36 have retained their names, although they have changed from the manufacture of bicycles and tricycles to some other industry.

Table 4 is a comparative summary, by states, of the figures reported by manufacturers engaged primarily in the production of bicycles and tricycles in 1900 and 1905.

TABLE 4.—COMPARATIVE SUMMARY, BY STATES: 1905 AND 1900.

STATE.	Year.	Number of establishments.	Capital.	Salaried officials, clerks, etc.: Number.	Salaried officials, clerks, etc.: Salaries.	Wage-earners and wages: Average number.	Wage-earners and wages: Wages.	Miscellaneous expenses.	Cost of materials used.	Value of products.
United States	1905	101	$5,883,458	361	$350,798	3,319	$1,971,403	$574,655	$2,628,146	$5,153,240
	1900	312	29,783,659	2,034	1,753,235	17,525	8,189,817	2,252,604	16,792,051	31,915,908
California	1905	4	13,531	2	1,300	10	6,010	3,029	15,708	29,652
	1900	4	19,254	.....	.....	19	11,080	3,144	25,470	47,670
Connecticut [1]	1900	24	4,215,399	263	251,091	2,139	1,150,736	323,629	1,720,249	3,672,225
Illinois	1905	13	1,029,875	82	82,304	969	593,902	76,915	512,753	1,161,481
	1900	60	7,694,658	642	522,477	4,388	2,144,897	630,442	4,836,585	8,960,421
Indiana [1]	1900	19	2,061,560	123	96,996	1,481	613,840	121,260	1,221,786	2,115,901
Massachusetts	1905	8	689,567	47	45,026	344	180,384	110,908	289,107	582,047
	1900	25	2,646,498	139	117,242	1,581	815,028	125,076	1,307,900	2,715,310
Michigan	1905	4	238,330	19	13,225	79	47,763	24,567	95,709	208,384
	1900	11	757,021	53	39,643	311	141,639	59,485	345,725	627,658
Minnesota	1905	8	18,235	2	1,060	11	6,088	3,354	14,407	34,016
	1900	4	38,205	2	2,320	47	8,440	4,673	30,997	66,505
New Jersey	1905	3	11,300	2	1,404	2	1,060	1,458	4,539	12,162
	1900	7	204,465	24	23,457	183	71,343	19,548	147,317	295,226
New York	1905	32	657,529	28	25,974	410	205,945	83,268	347,165	758,789
	1900	66	3,326,943	267	216,120	2,103	988,052	366,501	1,856,065	3,842,020
Ohio	1905	3	1,132,225	61	62,296	446	292,780	158,556	456,656	1,040,982
	1900	34	4,074,576	209	197,406	2,380	1,017,061	247,332	2,251,358	4,099,980
Pennsylvania	1905	12	209,909	6	3,940	94	51,762	30,670	130,181	250,348
	1900	24	1,550,957	110	91,681	947	431,369	128,931	1,065,461	1,855,043
Rhode Island [1]	1900	4	24,300	6	3,600	17	6,100	1,309	23,195	43,382
Wisconsin	1905	3	31,212	3	2,388	12	6,925	10,892	18,781	44,456
	1900	23	2,337,975	160	134,007	1,572	625,149	170,266	1,536,592	2,795,236
All other states	[2] 1905	11	1,851,745	109	111,881	942	578,784	71,038	743,140	1,030,923
	[3] 1900	7	831,848	36	57,195	357	165,083	51,008	423,351	779,331

[1] Included in "all other states" in 1905.
[2] Includes establishments distributed as follows: Colorado, 2; Connecticut, 2; Indiana, 2; Maryland, 1; Missouri, 2; North Carolina, 1; Rhode Island, 1.
[3] Includes establishments distributed as follows: Colorado, 1; Iowa, 1; Kentucky, 1; Maine, 1; Maryland, 1; Nevada, 1; New Hampshire, 1.

The most noticeable feature in Table 4 is the decrease in Connecticut, Illinois, Indiana, Massachusetts, New York, Ohio, Pennsylvania, and Wisconsin, that for the last-named state being most prominent. In 1900 each of these states produced bicycles and tricycles valued at over $1,000,000, while in 1905 the product of but 2, Illinois and Ohio, was valued at $1,000,000 or over.

Exports.—The value of bicycles and tricycles and parts thereof exported from the United States each year from 1896 to 1905, inclusive, is shown in Table 5.

TABLE 5.—*Value of exports of bicycles and tricycles, and parts thereof: 1896 to 1905.*[1]

FISCAL YEAR.	Exports.	FISCAL YEAR.	Exports.
1896	$1,898,012	1901	$2,515,804
1897	7,005,323	1902	2,627,572
1898	6,846,529	1903	2,132,629
1899	5,753,880	1904	1,965,026
1900	3,553,149	1905	1,378,428

[1] "Commerce and Navigation of the United States," Bureau of Statistics, Department of Commerce and Labor.

The high tide of bicycle export from the United States was reached in 1897, when the American wheel commanded a market not only in nonmanufacturing countries, but also in the United Kingdom and throughout continental Europe. Excepting a slight increase in 1902 over the previous year, the decline in the export trade has kept pace with the decline in the popularity of the bicycle.

Historical and descriptive.—The history of the bicycle was discussed in the Report on Manufactures, Twelfth Census, Part IV. The history of the manufacture of motor cycles was not dwelt upon at that time but is here introduced.

The first power-driven bicycle produced in the United States was a steam "boneshaker," made and used in 1868 by W. W. Austin, of Winthrop, Mass.[1] This machine, which weighed 90 pounds, is said to have run about 2,000 miles. The engine and boiler were attached to the frame just back of the rider.[2]

[1] The Bicycling World, Vol. XLIII, No. 15, Jan. 10, 1901, page 370.
[2] The Bicycling World, Vol. XLII, No. 7, Nov. 15, 1900, page 141.

During 1884–85 the better known "Copeland steam bicycle" was devised by W. E. and L. D. Copeland, of San Francisco, Cal. The wheel used was of the regular "Star" pattern, and the engine and boiler were planned so as to occupy very little space outside the lines of the machine. The engine proper weighed 1 pound and 12 ounces, including the driving pulley, and the speed was 7 revolutions to 1 of the bicycle. The engine was capable of making 1,000 revolutions per minute. Enough water could be taken into the boiler to last an hour, and the power of the engine was sufficient to drive the 51-inch wheel about 12 miles on a floor, or about 1 mile in eight minutes on the road.[1]

So far as known nothing else in the form of a motor cycle was attempted in this country during the succeeding ten years. During the year 1894–95, when the safety bicycle and pneumatic tires were firmly established, E. J. Pennington, of Cleveland, Ohio, formed the Motor Cycle Company, and advertised extensively both a single and tandem power-driven machine. Kerosene was the fuel used, and it was claimed that 1 gallon would serve for 200 miles. Explosions which drove the machine were caused by electric ignition, the mere pressure of an electric button on the handle bar being sufficient to start or stop the machine and also to regulate the speed. While the contrivance was most ingenious, it was in advance of the times, the public not then being interested in power-driven cycles.[1]

In 1884 Gottlieb Daimler, of Deutz, Germany, produced and patented a small gas engine designed to run at very high speed, so high that the heat generated by it was enough to ignite the charges of gas furnishing the propelling power. This engine Mr. Daimler, in 1886, fitted to a bicycle by placing it vertically between the front and rear wheels, the rear wheel being driven from the engine by means of a belt. Gas was supplied from a carburetor in which an explosive vapor was produced by causing air to enter the liquid from below. This engine proved so satisfactory that Daimler continued work on it, and in 1889 constructed a two-cylinder engine, the piston rods of which were coupled to a single crank.[2]

From 1900 to the present time increased attention has been given to motor cycles, with the result that to-day there are many types upon the market, the majority, if not all, being propelled by a gasoline motor.

Under the report on automobiles in this volume the gasoline motor has been so generally covered that it was not considered necessary to give this subject any further attention in this article.

The detailed statistics for the bicycle and tricycle industry in establishments devoted primarily to their manufacture are presented in Table 6, which gives separate totals for each state in which there are three or more establishments, and groups the statistics for other states so as not to disclose the operations of individual establishments.

[1] The Bicycling World, Vol. XLI, No. 6, May 10, 1900, page 157.

[2] The Complete Motorist, page 28.

TABLE 6.—BICYCLES AND TRICYCLES—

		United States.[1]	California.	Illinois.
1	Number of establishments	101	4	13
	Capital:			
2	Total	$5,883,458	$13,531	$1,029,875
3	Land	$282,740		$47,036
4	Buildings	$1,115,039		$142,840
5	Machinery, tools, and implements	$2,360,698	$2,317	$432,196
6	Cash and sundries	$2,124,981	$11,214	$407,803
7	Proprietors and firm members	81	3	6
	Salaried officials, clerks, etc.:			
8	Total number	361	2	82
9	Total salaries	$350,798	$1,300	$82,304
	Officers of corporations—			
10	Number	31	1	5
11	Salaries	$76,216	$700	$7,780
	General superintendents, managers, clerks, etc.—			
12	Total number	330	1	77
13	Total salaries	$274,582	$600	$74,524
	Men—			
14	Number	275	1	69
15	Salaries	$251,717	$600	$71,874
	Women—			
16	Number	55		8
17	Salaries	$22,865		$2,650
	Wage-earners, including pieceworkers, and total wages:			
18	Greatest number employed at any one time during the year	4,893	12	1,624
19	Least number employed at any one time during the year	1,740	8	371
20	Average number	3,319	10	969
21	Total wages	$1,971,403	$6,010	$593,902
	Men 16 years and over—			
22	Average number	3,298	10	968
23	Wages	$1,964,940	$6,010	$593,641
	Women 16 years and over—			
24	Average number	7		1
25	Wages	$3,481		$261
	Children under 16 years—			
26	Average number	14		
27	Wages	$2,982		
	Average number of wage-earners, including pieceworkers, employed during each month:[2]			
	Men 16 years and over—			
28	January	4,075	11	1,457
29	February	4,260	11	1,547
30	March	4,205	12	1,498
31	April	3,719	12	915
32	May	3,676	12	868
33	June	3,322	11	797
34	July	2,550	9	566
35	August	2,149	8	557
36	September	2,309	8	651
37	October	2,578	8	742
38	November	3,047	9	875
39	December	3,686	9	1,143
	Miscellaneous expenses:			
40	Total	$574,655	$3,029	$76,915
41	Rent of works	$58,453	$1,665	$31,050
42	Taxes	$29,963	$56	$5,357
43	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$408,044	$1,308	$40,508
44	Contract work	$78,195		
	Materials used:			
45	Total cost	$2,628,146	$15,708	$512,753
46	Principal materials	$2,039,566	$14,350	$378,158
47	Fuel	$85,791	$122	$21,318
48	Rent of power and heat	$19,712	$186	$400
49	Mill supplies	$42,884	$100	$11,700
50	All other materials	$404,327	$800	$96,212
51	Freight	$35,866	$150	$4,965
	Products:			
52	Aggregate value	$5,153,240	$29,652	$1,161,481
	Bicycles—			
53	Total number	227,504	996	80,231
54	Total value	$3,557,635	$17,125	$907,010
	Individual—			
	Chainless—			
55	Number	3,675		1,244
56	Value	$118,016		$37,470
	Chain—			
57	Number	221,428	990	78,730
58	Value	$3,081,206	$15,925	$825,012
	Tandem—			
59	Number	106		22
60	Value	$4,283		$900
	Motor—			
61	Number	2,295	6	235
62	Value	$354,130	$1,200	$43,628
	Tricycles—			
63	Number	4,063	30	
64	Value	$33,560	$3,000	
65	All other products	$1,273,326	$1,284	$234,523
66	Amount received for custom work and repairing	$288,719	$8,243	$19,948

[1] Includes establishments distributed as follows: Colorado, 2; Connecticut, 2; Indiana, 2; Maryland, 1; Missouri, 2; North Carolina, 1; Rhode Island, 1.

DETAILED SUMMARY, BY STATES: 1905.

Massachusetts.	Michigan.	Minnesota.	New Jersey.	New York.	Ohio.	Pennsylvania.	Wisconsin.	All other states.[1]	
8	4	8	3	32	3	12	3	11	1
$689,567	$238,330	$18,235	$11,300	$657,529	$1,132,225	$209,909	$31,212	$1,851,745	2
$4,400	$2,500	$1,900	....	$25,250	$30,529	$27,100	....	$144,025	3
$106,247	$29,189	$2,400	....	$81,459	$199,130	$28,701	$2,225	$522,848	4
$344,710	$48,334	$5,700	$2,800	$277,114	$395,056	$46,121	$10,775	$795,575	5
$234,210	$158,307	$8,235	$8,500	$273,706	$507,510	$107,987	$18,212	$389,297	6
[illegible]	2	7	2	28	....	15	4	8	7
47	19	2	2	28	61	6	3	109	8
$45,026	$13,225	$1,060	$1,404	$25,974	$62,296	$3,940	$2,388	$111,881	9
....	2	....	1	8	7	....	2	5	10
....	$5,000	....	$780	$8,400	$13,800	....	$1,920	$37,836	11
47	17	2	1	20	54	6	1	104	12
$45,026	$8,225	$1,060	$624	$17,574	$48,496	$3,940	$468	$74,045	13
36	12	2	1	13	40	4	....	97	14
$39,568	$6,320	$1,060	$624	$14,062	$42,644	$3,280	....	$71,685	15
11	5	....	....	7	14	2	1	7	16
$5,458	$1,905	....	....	$3,512	$5,852	$660	$468	$2,360	17
492	118	13	3	620	555	157	19	1,275	18
213	23	9	3	192	295	61	8	557	19
344	79	11	2	410	446	94	12	942	20
$180,384	$47,763	$6,088	$1,060	$205,945	$292,780	$51,762	$6,925	$578,784	21
335	79	11	2	407	446	90	12	938	22
$178,030	$47,763	$6,088	$1,060	$205,113	$292,780	$51,060	$6,925	$576,470	23
3	....	....	....	....	....	....	....	3	24
$1,088	....	....	....	....	....	....	....	$2,132	25
[illegible]	....	....	....	3	....	4	....	1	26
$1,266	....	....	....	$832	....	$702	....	$182	27
437	111	7	2	475	474	78	8	1,015	28
450	110	8	2	524	500	81	9	1,018	29
401	97	16	2	547	486	87	10	1,049	30
357	80	15	2	534	503	102	13	1,186	31
324	76	14	2	461	552	103	17	1,247	32
277	71	14	2	353	523	102	19	1,153	33
244	29	13	2	355	379	93	18	842	34
257	21	12	2	284	314	81	16	597	35
237	55	11	2	266	349	72	12	646	36
238	89	11	2	312	346	75	10	745	37
320	103	6	2	343	444	98	6	841	38
478	106	5	2	430	482	108	6	917	39
$110,908	$24,567	$3,354	$1,458	$83,268	$158,556	$30,670	$10,892	$71,038	40
$2,220	$740	$1,768	$570	$10,604	$720	$3,740	$844	$4,532	41
$3,064	$918	$150	$8	$2,644	$3,078	$544	$76	$14,068	42
$35,584	$22,609	$1,311	$880	$69,287	$154,758	$26,386	$2,975	$52,438	43
$70,040	$300	$125	....	$733	....	....	$6,997	....	44
$289,107	$95,709	$14,407	$4,539	$347,165	$456,656	$130,181	$18,781	$743,140	45
$238,189	$83,915	$13,071	$3,020	$287,932	$326,582	$124,418	$17,734	$552,197	46
$13,262	$3,243	$210	$55	$7,393	$17,073	$2,714	$532	$19,869	47
$520	$12	$336	....	$6,059	$10,647	$503	$20	$1,029	48
$5,808	$1,487	$25	$4	$3,795	$3,384	$195	$425	$15,961	49
$28,407	$5,852	$765	$1,450	$38,170	$92,286	$500	....	$139,885	50
$2,921	$1,200	....	$10	$3,816	$6,684	$1,851	$70	$14,199	51
$582,047	$208,384	$34,016	$12,162	$758,789	$1,040,982	$250,348	$44,456	$1,030,923	52
13,456	8,225	297	398	29,089	36,138	5,769	575	52,330	53
$537,403	$186,200	$16,737	$5,591	$367,094	$671,330	$127,195	$36,930	$685,020	54
495	....	....	....	200	....	10	....	1,726	55
$18,850	....	....	....	$7,000	....	$500	....	$54,196	56
11,782	8,225	228	398	28,723	35,985	5,680	395	50,292	57
$333,736	$186,200	$8,892	$5,591	$338,379	$654,792	$115,525	$9,930	$587,224	58
83	....	....	....	1	....	....	....	....	59
$3,333	....	....	....	$50	....	....	....	....	60
1,096	....	69	....	165	153	79	180	312	61
$181,484	....	$7,845	....	$21,665	$16,538	$11,170	$27,000	$43,600	62
....	2	....	....	....	3,038	993	....	....	63
....	$350	....	....	....	$26,493	$3,717	....	....	64
$42,084	$7,000	$600	$1,350	$345,677	$319,335	$95,726	$850	$224,897	65
$2,560	$14,834	$16,679	$5,221	$46,018	$23,824	$23,710	$6,676	$121,006	66

[2] The average number of women 16 years and over and children under 16 years, employed during each month, are not included in the table because of the small number reported.

TABLE 6.—BICYCLES AND TRICYCLES—

		United States.	California.	Illinois.
	Power:			
67	Number of establishments reporting	80	3	10
68	Total horsepower	7,131	8	2,939
	Owned—			
	Engines—			
	Steam—			
69	Number	49		20
70	Horsepower	4,906		2,208
	Gas or gasoline—			
71	Number	34	1	4
72	Horsepower	231	4	16
	Water wheels—			
73	Number	2		
74	Horsepower	35		
	Electric motors—			
75	Number	50		23
76	Horsepower	1,401		705
	Rented—			
	Electric motors—			
77	Number	42	2	1
78	Horsepower	336	4	10
79	Other kind, horsepower	222		
80	Furnished to other establishments, horsepower	2		2

DETAILED SUMMARY, BY STATES: 1905—Continued.

Massachusetts.	Michigan.	Minnesota.	New Jersey.	New York.	Ohio.	Pennsylvania.	Wisconsin.	All other states.	
8	4	5	1	23	3	10	3	10	67
1,130	232	11	4	612	655	128	32	1,380	68
7	3	...	1	4	2	3	...	9	69
613	225	...	4	362	229	55	...	1,210	70
3	1	1	...	6	4	3	3	8	71
14	3	3	...	19	105	16	32	19	72
...	...	...	...	2	...	...	...	...	73
...	...	...	...	35	...	...	...	...	74
9	1	...	...	...	10	...	...	7	75
485	1	...	...	...	108	...	...	102	76
2	1	4	...	10	13	2	...	7	77
8	3	8	...	38	213	3	...	49	78
10	...	...	...	158	...	54	...	...	79
...	...	...	...	...	...	...	...	...	80

CARRIAGES AND WAGONS

CARRIAGES AND WAGONS.

This report embraces establishments conducted on the factory system engaged in the manufacture of every variety of vehicle propelled by animal power for land transportation. It does not include statistics for children's carriages and sleds, bicycles and tricycles, automobiles and other horseless conveyances—except when made as subsidiary products—or for steam and street railroad cars.

The census of 1890 was the first at which establishments engaged in the manufacture of the factory product were segregated from those engaged chiefly in custom and repair work and shown in a separate table, distinct from the totals for the regular classification.

In order that the statistics for the census of 1900 might be strictly comparable with those for 1890 and 1905, a revision was made by which reports for 1,428 establishments, representing capital of $8,311,953 and products of $8,302,686, were eliminated. These reports represented practically all the carriage and wagon custom work and repairing plants, classified under "carriages and wagons" in 1900, and all the plants showing an entire or preponderating product of automobiles. The schedules for the latter were separately compiled to show elsewhere comparative figures for the classification of "automobiles," used for the first time at the census of 1905.

Table 1 is a comparative summary of the statistics for carriages and wagons, factory product, as returned at the censuses of 1890, 1900, and 1905, with percentages of increase.

The figures given for the census of 1905 show a substantial increase over those for 1900, with the single exception of number of establishments; this item is diminished by 1,248, or 20.1 per cent. The decrease is due in part to the fact that it was impossible to eliminate from the statistics for 1900 all the reports for establishments of the character excluded from the factory census of 1905.

The average number of wage-earners increased only 3.4 per cent from 1890 to 1900, while the total wages paid actually decreased 4.8 per cent, but at the census of 1905 these items showed increases of 3.9 per cent and 12 per cent, respectively. The cost of materials used increased 13.9 per cent from 1900 to 1905, and the increase shown in total value of products was 10.7 per cent.

TABLE 1.—*Comparative summary, with per cent of increase: 1890 to 1905.*

	CENSUS.			PER CENT OF INCREASE.	
	1905[1]	1900	1890	1900 to 1905	1890 to 1900
Number of establishments	4,956	6,204	4,572	[2] 20.1	35.7
Capital	$126,320,604	$109,875,885	$93,455,257	15.0	17.6
Salaried officials, clerks, etc., number	5,058	4,003	[3] 6,069	26.4	[2] 34.0
Salaries	$5,239,043	$3,756,915	[3] $5,715,426	39.5	[2] 34.3
Wage-earners, average number	60,722	58,425	56,525	3.9	3.4
Total wages	$30,878,229	$27,578,046	$28,972,401	12.0	[2] 4.8
Men 16 years and over	59,411	57,209	55,403	3.8	3.3
Wages	$30,525,515	$27,264,021	$28,702,169	12.0	[2] 5.0
Women 16 years and over	870	840	615	3.6	36.6
Wages	$266,674	$248,071	$180,195	7.5	37.7
Children under 16 years	441	376	507	17.3	[2] 25.8
Wages	$86,040	$65,954	$90,037	30.5	[2] 26.7
Miscellaneous expenses	$10,182,614	$5,800,687	$5,495,271	75.5	5.6
Cost of materials used	$61,215,228	$53,723,311	$46,022,769	13.9	16.7
Value of products, including amount received for repair work	$125,332,976	$113,234,590	$102,680,341	10.7	10.3

[1] Exclusive of the statistics of 35 establishments engaged primarily in the manufacture of other products. These establishments made carriages and wagons to the value of $612,173.
[2] Decrease.
[3] Includes proprietors and firm members and their salaries; number only reported in 1900 and 1905, but not included in this table.

The industry, by states and territories.—Table 2 is a comparative summary for the industry, by states and territories and geographic divisions, 1900 and 1905.

By far the larger part of the carriage and wagon industry was concentrated in the North Central division. At the census of 1905 this division contained 60 per cent of the total capital invested, 51.5 per cent of the wage-earners, 50.2 per cent of the wages, and 58 per cent of the value of products. Indiana and Illinois were the only states showing important increases.

The North Atlantic division ranked next to the North Central, with 26.3 per cent of the capital for the whole country, 30.9 per cent of the wage-earners, 33.8 per cent of the wages, and 25.6 per cent of the value of products. Of the separate states all reported a general decline except Maine, New York, and Pennsylvania.

TABLE 2.—COMPARATIVE SUMMARY, BY STATES, TERRITORIES, AND GEOGRAPHIC DIVISIONS: 1905 AND 1900.

STATE OR TERRITORY.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products, including amount received for repair work.
				Number.	Salaries.	Average number.	Wages.			
United States	1905	4,956	$126,320,604	5,058	$5,239,043	60,722	$30,878,229	$10,182,614	$61,215,228	$125,332,976
	1900	6,204	109,875,885	4,003	3,756,915	58,425	27,578,046	5,800,687	53,723,311	113,234,590
North Atlantic division	1905	2,022	33,258,486	1,117	1,228,223	18,769	10,421,971	2,657,271	12,683,572	32,133,890
	1900	2,453	33,877,100	965	917,590	18,375	9,850,301	1,793,829	12,913,510	32,744,207
Maine	1905	154	660,764	14	11,499	451	243,578	44,061	392,280	937,644
	1900	147	575,350	16	10,100	331	168,899	23,996	264,076	690,009
New Hampshire	1905	39	814,372	16	20,650	382	229,624	36,146	195,851	565,944
	1900	53	1,049,245	24	22,458	496	260,111	39,371	268,192	722,118
Vermont	1905	32	214,301	1	1,000	108	58,825	8,353	54,816	163,756
	1900	57	315,663	3	1,275	186	91,364	12,836	98,442	284,525
Massachusetts	1905	280	3,813,839	120	109,140	2,232	1,367,349	336,954	1,656,271	4,179,724
	1900	310	4,912,227	120	89,816	2,691	1,411,282	280,740	2,173,458	5,031,804
Rhode Island	1905	30	328,684	8	6,756	228	140,218	19,086	116,627	369,870
	1900	49	361,311	12	8,612	290	170,490	25,553	186,887	520,734
Connecticut	1905	96	2,087,840	82	110,508	1,372	690,185	104,042	666,068	1,909,483
	1900	114	2,726,836	57	66,010	1,289	841,986	96,718	831,970	2,302,881
New York	1905	590	13,962,721	490	604,819	6,789	3,936,924	1,313,204	5,008,143	12,573,148
	1900	745	13,258,897	428	461,819	6,548	3,652,432	829,785	4,888,694	12,261,863
New Jersey	1905	200	2,545,445	76	86,541	1,638	960,903	191,970	1,036,002	2,813,534
	1900	238	2,567,883	74	68,480	1,599	875,259	139,709	1,100,936	2,972,212
Pennsylvania	1905	601	8,830,520	310	277,310	5,569	2,794,365	603,455	3,557,514	8,620,787
	1900	740	8,109,688	231	189,020	4,945	2,378,478	345,121	3,100,855	7,958,061
South Atlantic division	1905	533	7,386,888	304	285,291	5,260	2,055,181	489,003	4,717,249	9,303,867
	1900	677	4,568,229	154	123,364	3,945	1,414,332	209,030	2,510,719	5,861,649
Delaware	1905	21	264,783	8	5,260	137	68,992	15,504	102,352	228,350
	1900	22	397,103	11	9,506	205	96,263	17,155	101,847	281,396
Maryland	1905	111	898,874	31	17,966	774	347,236	63,496	487,231	1,143,463
	1900	109	589,208	17	11,256	624	249,954	30,766	281,761	791,571
District of Columbia	1905	6	50,117	1	1,560	52	25,249	4,873	21,776	75,265
	1900	5	42,350	1	780	42	19,050	1,963	16,567	54,200
Virginia	1905	92	1,615,715	70	61,226	1,046	372,490	81,938	1,029,976	1,913,530
	1900	144	1,098,037	33	30,805	756	304,075	51,581	591,336	1,370,824
West Virginia	1905	34	313,614	18	16,375	221	113,032	20,826	210,452	443,291
	1900	49	311,290	7	6,576	240	105,345	10,745	166,703	379,098
North Carolina	1905	125	2,010,457	64	59,628	1,373	481,528	109,190	1,229,396	2,304,065
	1900	157	860,683	29	19,257	799	236,230	30,042	520,814	1,055,292
South Carolina	1905	38	502,243	16	20,480	346	118,280	28,441	289,740	548,226
	1900	56	313,698	14	12,060	340	90,655	15,414	206,414	414,052
Georgia	1905	75	1,508,958	87	96,786	1,115	426,484	137,456	1,222,149	2,303,196
	1900	104	824,933	39	31,024	808	256,511	44,341	533,931	1,316,997
Florida	1905	31	222,127	9	6,010	196	101,890	27,279	124,177	344,481
	1900	31	130,927	3	2,100	131	56,249	7,023	91,346	198,219
North Central division	1905	1,831	75,836,912	3,232	3,315,467	31,292	15,511,413	6,181,307	38,740,019	72,614,891
	1900	2,371	64,283,824	2,596	2,453,645	31,229	14,139,433	3,398,375	34,572,658	66,174,777
Ohio	1905	348	12,980,183	741	707,490	6,768	3,335,551	1,481,585	8,437,352	16,096,125
	1900	449	11,983,270	679	570,537	7,129	3,290,195	793,896	8,153,691	15,616,926
Indiana	1905	188	22,276,315	796	808,928	7,156	3,254,027	1,173,980	8,598,170	15,228,337
	1900	262	17,664,364	596	580,862	6,425	2,727,020	671,743	6,957,203	12,661,217
Illinois	1905	290	10,838,860	401	466,781	4,186	2,320,141	844,469	4,885,773	9,798,965
	1900	335	8,463,226	302	317,505	3,979	1,954,910	467,048	4,002,145	8,275,639
Michigan	1905	183	9,264,093	514	493,523	4,688	2,246,493	933,855	7,005,109	12,101,170
	1900	247	7,876,005	401	352,498	4,859	2,014,892	491,740	6,589,442	11,119,836
Wisconsin	1905	311	9,751,420	246	276,385	3,506	1,724,017	644,000	3,725,358	7,511,392
	1900	371	8,271,091	217	246,400	3,360	1,604,743	363,032	3,309,766	6,839,963
Minnesota	1905	134	2,159,885	74	79,516	872	424,777	135,948	781,727	1,715,858
	1900	176	1,822,926	50	49,724	1,055	456,447	102,110	867,193	1,930,745
Iowa	1905	97	3,107,725	175	176,950	1,103	528,016	424,778	1,479,085	2,974,043
	1900	110	3,888,225	140	112,704	1,584	666,450	234,336	1,792,935	3,728,027
Missouri	1905	222	4,876,917	260	285,791	2,636	1,477,540	490,140	3,587,478	6,551,130
	1900	346	3,937,371	186	207,065	2,524	1,274,012	244,890	2,696,598	5,477,151
North Dakota [1]	1900	11	38,510	....	....	22	11,336	1,511	17,207	39,289
South Dakota	1905	3	54,415	2	2,000	19	12,528	2,010	9,903	31,119
	1900	9	43,750	....	....	26	13,532	1,606	20,491	48,895
Nebraska	1905	17	202,933	11	8,823	144	83,155	24,252	113,340	285,984
	1900	24	121,859	7	6,370	105	58,034	11,559	66,892	194,557
Kansas	1905	38	324,166	12	9,280	214	105,168	26,290	116,724	320,768
	1900	31	173,227	18	9,980	161	67,862	14,904	99,095	242,532

[1] Included in "not distributed by states or divisions" in 1905.

TABLE 2.—COMPARATIVE SUMMARY, BY STATES, TERRITORIES, AND GEOGRAPHIC DIVISIONS: 1905 AND 1900—Continued.

STATE OR TERRITORY.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC. Number.	SALARIED OFFICIALS, CLERKS, ETC. Salaries.	WAGE-EARNERS AND WAGES. Average number.	WAGE-EARNERS AND WAGES. Wages.	Miscellaneous expenses.	Cost of materials used.	Value of products, including amount received for repair work.
South Central division	1905	294	$7,422,971	324	$330,966	3,951	$1,821,069	$625,231	$3,831,851	$7,854,827
	1900	407	5,138,868	219	198,521	3,520	1,380,097	269,809	2,687,992	5,711,824
Kentucky	1905	102	4,225,145	163	163,350	1,812	800,331	354,043	2,089,687	4,059,438
	1900	143	3,075,823	122	116,935	1,669	621,904	143,736	1,496,001	2,849,713
Tennessee	1905	59	1,445,350	83	94,346	917	416,682	122,837	898,447	1,774,725
	1900	71	759,057	43	44,462	607	253,336	42,030	508,578	1,093,782
Alabama	1905	23	558,163	28	28,021	370	161,399	77,199	369,470	720,282
	1900	41	380,966	24	15,985	401	126,917	40,417	226,680	544,602
Mississippi	1905	12	303,120	17	17,244	171	74,953	16,045	96,491	239,566
	1900	20	91,175	4	3,500	107	41,897	3,132	42,804	123,610
Louisiana	1905	40	236,770	11	10,576	293	159,317	17,862	151,365	436,434
	1900	41	260,012	13	8,359	285	119,386	12,360	128,350	359,506
Arkansas	1905	16	314,919	12	8,373	134	60,898	12,872	70,219	189,914
	1900	26	160,873	5	2,300	134	48,847	7,159	94,495	197,423
Oklahoma	1905	8	53,990	1	520	43	23,407	3,149	26,008	66,921
	1900	7	24,500			27	9,142	685	10,771	37,445
Texas	1905	34	285,514	9	8,536	211	124,082	21,224	130,164	367,547
	1900	58	386,462	8	6,980	290	158,668	20,290	180,313	505,743
Western division	1905	271	2,387,317	80	77,296	1,425	1,054,300	225,577	1,225,184	3,381,756
	1900	293	2,004,599	69	63,795	1,353	791,359	129,372	1,035,117	2,730,688
Montana	1905	6	60,258	6	6,000	23	19,900	5,530	37,369	107,060
	1900	7	63,899	4	4,080	30	31,118	5,719	32,433	100,560
Wyoming [1]	1900	7	22,890	1	1,800	18	10,260	1,366	29,227	65,485
Colorado	1905	35	262,888	9	8,900	177	129,557	21,262	132,648	379,368
	1900	40	292,871	11	10,960	174	120,205	18,044	138,825	384,994
New Mexico	1905	4	61,050	2	1,920	26	19,947	1,201	27,364	65,850
	1900	3	21,750			11	6,200	1,193	5,830	19,100
Arizona [1]	1900	4	47,350	4	1,180	22	14,848	1,257	11,438	40,210
Utah	1905	3	2,950			8	5,675	702	4,315	12,300
	1900	4	28,674	7	1,000	34	13,950	1,525	21,976	53,693
Washington	1905	25	230,418	12	10,768	201	158,200	21,503	188,314	482,263
	1900	25	97,860	8	8,800	132	88,901	9,400	110,219	283,218
Oregon	1905	14	93,595	4	1,033	52	36,209	5,940	45,761	114,429
	1900	19	70,451	2	200	56	35,286	4,972	43,039	112,699
California	1905	184	1,676,158	47	48,675	938	684,812	169,439	789,413	2,220,486
	1900	184	1,358,854	32	35,775	876	470,591	85,896	642,130	1,670,729
Not distributed by states or divisions	[2] 1905	5	28,030	1	1,800	25	14,295	4,225	17,353	43,745
	[3] 1900	3	3,265			3	2,524	272	3,315	11,445

[1] Included in "not distributed by states or divisions" in 1905.
[2] Includes establishments distributed as follows: Arizona, 1; Indian Territory, 1; Nevada, 1; North Dakota, 1; Wyoming, 1.
[3] Includes establishments distributed as follows: Indian Territory, 1; Nevada, 2.

The Southern states, though still forming relatively small proportions of the total, showed substantial increases. The two divisions into which they were grouped were nearly equal in importance. The South Atlantic was in the lead with 7.4 per cent of the total value of products against 6.3 per cent for the South Central. The gain in the South Atlantic division was mainly due to the large increase in North Carolina, while more than half the increase in the South Central division was credited to Kentucky.

The figures for the Western division are relatively small, and the substantial gains in the various items are not sufficient to cause any material change in the percentages of the totals compared with 1900. California, Oregon, Washington, Montana, and New Mexico show a gain in value of products, the other states showing losses.

In value of products, Ohio was the leading state at the censuses of both 1900 and 1905. At the later census this value was 12.8 per cent of the total output, as against 13.8 per cent of the total for 1900. Indiana, New York, Michigan, and Illinois came next, in the order named, at both censuses, with 11.2, 10.8, 9.8, and 7.3 per cent, respectively, of the total value in 1900; and 12.2, 10, 9.7, and 7.8 per cent at the census of 1905. Relatively, Indiana and Illinois alone advanced, Michigan about holding its own and New York losing ground.

Five states showed an increase of over $1,000,000 between 1900 and 1905, Indiana, Illinois, North Carolina, Kentucky, and Missouri, in the order named. Wisconsin reported an increase of less than $700,000. Georgia ranked next to the 5 states mentioned with $986,199, or more than double the increase for Ohio, the state first in rank according to total value. The percentages of increase in these states were also nota-

ble—20.3 for Indiana, 18.4 for Illinois, 118.3 for North Carolina, 42.5 for Kentucky, 19.6 for Missouri, and 74.9 for Georgia. Ohio's increase was only 3.1 per cent.

An examination of the figures for wage-earners and wages shows that of the 15 leading states, according to value of products, 4 reported fewer wage-earners at the census of 1905 than in 1900. The states showing these losses were: Iowa, 481, or 30.4 per cent; Massachusetts, 459, or 17.1 per cent; Ohio, 361, or 5.1 per cent; and Michigan, 171, or 3.5 per cent. Of the states showing gains, Indiana reported the largest, 731, or 11.4 per cent, rising from third to first place; Pennsylvania was second with 624, or 12.6 per cent; North Carolina and Georgia were next with 574 and 307, or 71.8 and 38 per cent, respectively.

The industry in cities.—Of the total number of establishments in the United States reported at the census of 1905 as engaged in the manufacture of carriages and wagons, 1,914, or 38.6 per cent, were located in 195 of the 213 cities having a population in 1900 of at least 20,000. The capital invested in these establishments was $73,925,124, or 58.5 per cent; the salaries, $3,143,805, or 60 per cent; the wages, $18,466,168, or 59.8 per cent; the cost of materials used, $33,563,701, or 54.8 per cent; and the value of products, $70,212,541, or 56 per cent of the corresponding totals for the United States.

There are 16 cities with a population of 20,000 and over in 1900, in each of which carriages and wagons valued at more than $1,000,000 were manufactured as reported at the census of 1905. These in order of rank were: Cincinnati, Ohio; St. Louis, Mo.; South Bend, Ind.; New York, N. Y.; Chicago, Ill.; Racine, Wis.; Columbus, Ohio; Indianapolis, Ind.; Philadelphia, Pa.; Louisville, Ky.; Jackson, Mich.; Rochester, N. Y.; Kalamazoo, Mich.; Toledo, Ohio; Watertown, N. Y.; and Detroit, Mich. Products valued at $42,598,640, or 34 per cent of the total, were manufactured in these 16 cities. There were also a number of smaller cities in which a product in excess of $1,000,000 was reported. These are Flint and Pontiac, Mich.; Moline, Ill.; Connersville, Ind.; Owensboro, Ky.; and Stoughton, Wis.

Materials used.—Table 3 gives separately the cost, and, for some items, the quantity of the principal materials used at the last two censuses, together with percentages of increase.

Perhaps the most striking feature of the table is the decrease in the cost of iron and steel, but the extent of the decrease is more apparent than real, for in 1900 gears were not reported separately, being included with iron and steel. For 1905 there was also a closer segregation from iron and steel, of carriage hardware, lamps, and mountings, which assisted in the large gain in cost for the latter group of 52.6 per cent. The cost of lumber, which ranked with iron and steel as the most important material used in the industry, increased $1,650,187, or 19 per cent. The increase of $558,094, or 27 per cent, in the cost of rubber tires indicates the steadily increasing demand for those parts.

TABLE 3.—*Materials used, by kind, quantity, and cost, with per cent of increase: 1905 and 1900.*

KIND.	CENSUS. 1905	CENSUS. 1900	Per cent of increase.
Total cost	$61,215,228	$53,723,311	13.9
Lumber	$10,338,003	$8,687,816	19.0
Iron and steel	$9,854,548	$11,335,985	[1]13.1
Carriage hardware, lamps, and mountings	$5,219,958	$3,420,671	52.6
Paints, oils, turpentine, and varnish	$3,900,273	$3,887,399	0.3
Enamel, rubber, and other carriage cloth	$3,398,921	$3,061,613	11.0
Leather	$3,867,480	$3,443,639	12.3
Rubber tires	$2,626,889	$2,068,795	27.0
Carriage bodies, purchased:			
Number	485,879	441,396	10.1
Cost	$2,059,426	$1,635,661	25.9
Gears, purchased:			
Number	126,082	(2)	
Cost	$562,489	(2)	
Wagon bodies, purchased:			
Number	32,319	24,915	29.7
Cost	$208,058	$159,766	30.2
Tops, purchased:			
Number	22,426	38,483	[1]41.7
Cost	$168,922	$270,266	[1]37.5
Wheels, purchased:			
Number	3,628,889	3,594,573	1.0
Cost	$5,863,931	$5,205,729	12.6
Axles and springs, purchased	$4,460,759	$4,400,955	1.4
Fuel	$1,175,035	$918,810	27.9
Rent of power and heat	$180,470	$83,493	116.1
All other materials, including mill supplies and freight	$7,330,066	$5,142,713	42.5

[1] Decrease. [2] Not reported separately.

Products.—Table 4 shows separately the kind, quantity, and value of the different products as reported at the censuses of 1900 and 1905, with percentages of increase. The classification is based on the character of the vehicle and its proposed use. The item "all other products" includes the value of parts manufactured other than those that were components of the finished vehicles; the value of all subsidiary products, except that of automobiles, which is given separately; and the amount received for repair work.

TABLE 4.—*Products, by kind, quantity, and value, with per cent of increase: 1905 and 1900.*

KIND.	CENSUS. 1905	CENSUS. 1900	Per cent of increase.
Total value	$125,332,976	$113,234,590	10.7
Family and pleasure carriages:			
Number	937,409	904,639	3.6
Value	$55,750,276	$51,295,393	8.7
Public conveyances:			
Number	2,711	2,218	22.2
Value	$1,314,952	$1,114,090	18.0
Wagons (business, farm, government, municipal, etc.):			
Number	643,755	570,428	12.9
Value	$37,195,230	$31,080,738	19.7
Sleighs and sleds:			
Number	127,455	117,006	8.9
Value	$2,694,560	$2,290,903	17.6
Automobiles:			
Number	199	174	14.4
Value	$235,675	$129,053	82.6
All other products	$28,142,283	$27,324,413	3.0
Carriage bodies, number[1]	8,676	12,735	[2]31.9
Wagon bodies, number[1]	8,855	8,909	[2]0.5
Wheels, number[1]	389,266	148,158	162.7

[1] Value included in "all other products."
[2] Decrease.

For family and pleasure carriages an increase of 32,770, or 3.6 per cent, is shown in number, and of

$4,454,883, or 8.7 per cent, in value. The value reported for 1905 was 44.5 per cent of the total, a falling off of eight-tenths of 1 per cent. The average value was $57 for 1900 and $59 at the census of 1905. Wagons, which were the second largest class of products at both censuses, increased 73,327, or 12.9 per cent in number and $6,114,492, or 19.7 per cent, in value. The average value rose from $54 for 1900 to $58 for 1905. The automobiles shown are the few that were manufactured as a subsidiary product. The number of carriage bodies reported as manufactured for sale at the census of 1905 decreased 31.9 per cent and the number of wagon bodies five-tenths of 1 per cent. The number of wheels, however, increased 241,108, or 162.7 per cent. Deducting the value of "all other products" from the gross value for each of the two censuses, as shown in Table 4, a value of $97,190,693 results for 1905 and $85,910,177 for 1900. These figures represent the value of the finished vehicles reported at the two censuses and show an increase of $11,280,516, or 13.1 per cent.

Table 5 is a comparative summary of products for 1900 and 1905, by kind, quantity, and value, arranged by states and territories.

TABLE 5.—PRODUCTS, BY KIND, QUANTITY, AND VALUE—COMPARATIVE SUMMARY, BY STATES AND TERRITORIES: 1905 AND 1900.

STATE OR TERRITORY.	Census.	Total value.	FAMILY AND PLEASURE CARRIAGES.		PUBLIC CONVEYANCES.		WAGONS (BUSINESS, FARM, ETC.).		SLEIGHS AND SLEDS.		All other products, including amount received for repair work (value).
			Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	
United States	1905	$125,332,976	937,409	$55,750,276	2,711	$1,314,952	643,755	$37,195,230	127,455	$2,694,560	$28,377,958
	1900	113,234,590	904,639	51,295,393	2,218	1,114,090	570,428	31,080,738	117,006	2,290,903	27,453,466
Alabama	1905	720,282	504	36,657	2	490	12,512	527,987			155,148
	1900	544,602	924	49,513	5	1,140	9,523	368,115			125,834
Arizona[1]	1900	40,210	17	2,300			47	6,575			31,335
Arkansas	1905	189,914	35	2,045			1,625	102,736			85,133
	1900	197,423	800	55,828			1,149	71,355			70,240
California	1905	2,220,486	2,160	216,250	42	18,454	3,045	502,503	13	431	1,482,848
	1900	1,670,729	2,418	284,073	61	21,046	2,325	311,694	21	501	1,053,415
Colorado	1905	379,368	203	25,100			750	113,354	43	1,990	238,924
	1900	384,994	153	22,190			1,001	107,550	22	1,618	253,636
Connecticut	1905	1,909,483	2,381	753,306	179	153,875	1,944	224,365	383	18,643	759,294
	1900	2,302,881	2,940	1,013,179	170	115,450	1,427	142,974	267	12,016	1,019,262
Delaware	1905	228,350	1,219	104,663	1	200	695	57,312	3	38	66,137
	1900	281,396	1,150	138,131	3	450	1,224	73,656	3	85	69,074
District of Columbia	1905	75,265					99	22,165			53,100
	1900	54,200	3	725			74	14,950			38,525
Florida	1905	344,481	415	29,200	12	2,350	2,652	125,810			187,121
	1900	198,219	362	20,074	42	9,115	1,602	72,100			96,930
Georgia	1905	2,303,196	20,919	1,210,122	39	4,825	18,848	794,491			293,758
	1900	1,316,997	7,509	522,960	29	7,575	11,443	467,426			319,036
Illinois	1905	9,798,965	56,075	3,730,173	70	19,705	72,033	4,027,545	5,007	48,293	1,973,249
	1900	8,275,639	50,979	3,101,224	40	30,640	56,364	3,138,928	1,880	21,330	1,983,517
Indiana	1905	15,228,337	178,962	9,694,829	63	11,180	92,893	4,288,664	1,378	27,149	1,206,515
	1900	12,661,217	141,734	6,959,897	64	13,605	94,224	4,359,603	3,834	52,554	1,275,558
Iowa	1905	2,974,043	16,498	1,113,064	98	8,250	22,815	1,426,015	2,766	46,187	380,527
	1900	3,728,027	20,593	1,423,126	80	28,800	31,473	1,635,798	4,020	68,247	572,056
Kansas	1905	320,768	533	29,446	16	3,805	1,004	117,878			169,639
	1900	242,532	1,001	66,041	26	4,070	995	58,405	20	300	113,716
Kentucky	1905	4,059,438	27,195	1,302,914	1	225	49,266	2,332,327	4	41	423,931
	1900	2,849,713	11,784	654,024	25	2,295	39,362	1,661,367	87	1,188	530,839
Louisiana	1905	436,434	89	12,514	4	600	1,246	148,484			274,836
	1900	359,506	283	28,205	2	800	1,377	121,046	40	400	209,055
Maine	1905	937,644	2,802	272,244			1,764	154,989	2,802	117,075	393,336
	1900	690,009	2,294	268,094	3	1,350	1,172	87,015	2,315	93,944	239,606
Maryland	1905	1,143,463	2,945	291,881	8	2,025	1,849	225,360	62	1,909	622,288
	1900	791,571	3,091	256,262	11	3,120	1,144	173,187	80	1,385	357,617
Massachusetts	1905	4,179,724	8,106	1,480,339	142	113,760	3,278	605,678	1,062	79,824	1,900,123
	1900	5,031,804	11,883	1,886,987	310	210,700	3,944	623,303	870	80,206	2,230,608
Michigan	1905	12,101,170	174,889	7,784,444	120	116,026	52,273	2,352,958	53,180	977,822	869,920
	1900	11,119,836	193,254	7,425,754			49,903	2,049,460	51,149	846,765	797,857
Minnesota	1905	1,715,858	3,662	232,282	4	615	15,059	790,290	10,003	169,830	522,841
	1900	1,930,745	6,361	349,340	12	3,322	16,924	825,777	7,530	137,552	614,754
Mississippi	1905	239,566					2,012	171,535			68,031
	1900	123,610	195	8,650	3	400	883	45,685			68,875
Missouri	1905	6,551,130	74,650	3,826,342	58	4,445	25,281	1,507,225	6	153	1,212,965
	1900	5,477,151	52,823	2,797,118	88	24,550	24,621	1,392,102	170	3,204	1,260,177
Montana	1905	107,060	17	2,350			37	9,710			95,000
	1900	100,560	10	1,005	1	500	129	19,883	2	75	79,097

[1] Included in "all other states" in 1905.

TABLE 5.—PRODUCTS, BY KIND, QUANTITY, AND VALUE—COMPARATIVE SUMMARY, BY STATES AND TERRITORIES: 1905 AND 1900—Continued.

STATE OR TERRITORY.	Census.	Total value.	FAMILY AND PLEASURE CARRIAGES.		PUBLIC CONVEYANCES.		WAGONS (BUSINESS, FARM, ETC.).		SLEIGHS AND SLEDS.		All other products, including amount received for repair work (value).
			Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	
Nebraska	1905	$285,984	103	$18,637	[illegible]	$1,900	916	$72,644	2	$60	$192,743
	1900	194,557	449	41,770	3	1,150	203	19,889	4	125	131,623
New Hampshire	1905	565,944	1,943	163,657			1,188	219,923	694	33,141	149,223
	1900	722,118	2,240	217,551	3	600	2,394	288,306	924	37,197	178,464
New Jersey	1905	2,813,534	3,341	492,810	127	25,365	5,647	779,351	228	10,466	1,505,542
	1900	2,972,212	6,944	806,297	28	16,430	7,589	800,243	600	11,101	1,338,141
New Mexico	1905	65,850	38	3,500	21	2,350	146	12,480			47,520
	1900	19,100	18	1,820			88	6,280			11,000
New York	1905	12,573,148	42,249	4,550,893	742	518,469	19,879	2,448,670	19,433	592,768	4,462,348
	1900	12,261,863	58,176	4,939,609	656	489,142	22,775	2,186,935	14,500	412,075	4,234,102
North Carolina	1905	2,304,065	25,157	1,302,259	67	7,330	23,553	773,302	5	45	221,129
	1900	1,055,292	9,447	498,953	26	4,615	12,316	362,186	13	748	188,790
North Dakota [1]	1900	39,289	60	3,870			30	2,000	65	1,538	31,881
Ohio	1905	16,096,125	199,428	11,373,346	217	107,141	40,905	2,703,566	8,479	52,166	1,859,906
	1900	15,616,926	213,692	11,257,362	41	16,000	44,315	2,556,063	3,555	25,761	1,761,740
Oklahoma	1905	66,921	65	6,430	1	120	68	8,236			52,135
	1900	37,445	79	5,765	6	1,000	29	2,775	1	10	27,895
Oregon	1905	114,429	56	3,480	31	2,775	142	35,655	16	320	72,199
	1900	112,699	148	16,904	4	425	146	15,050	4	90	80,230
Pennsylvania	1905	8,620,787	33,467	2,355,043	333	117,093	35,395	2,839,372	5,551	150,461	3,158,818
	1900	7,958,061	41,400	2,816,780	141	27,645	27,138	2,161,435	5,509	118,449	2,833,752
Rhode Island	1905	369,870	40	4,660	1	177	481	59,682	163	5,695	299,656
	1900	520,734	339	51,385	6	600	942	101,835	146	7,335	359,579
South Carolina	1905	548,226	7,440	353,569	2	300	1,569	55,707			138,650
	1900	414,052	5,035	236,058	4	500	1,804	65,593			111,901
South Dakota	1905	31,119	15	1,555	1	150	47	5,830	9	184	23,400
	1900	48,895	52	4,255	3	1,200	70	8,190	12	170	35,080
Tennessee	1905	1,774,725	5,374	356,469	168	27,212	20,241	960,913			430,131
	1900	1,093,782	1,820	162,305	124	17,530	11,666	584,693			329,254
Texas	1905	367,547	100	11,425			718	76,349			279,773
	1900	505,743	750	56,915	22	9,475	1,050	90,330			349,023
Utah	1905	12,300	2	70	1	130	26	3,565	2	50	8,485
	1900	53,693	57	4,170	21	2,250	246	18,060	150	4,050	25,163
Vermont	1905	163,756	169	14,180			652	49,750	278	11,771	88,055
	1900	284,525	487	40,519			1,157	71,867	772	19,103	153,036
Virginia	1905	1,913,530	19,366	970,502	28	3,690	19,195	652,567	6	90	286,681
	1900	1,370,824	12,941	640,182	39	11,100	9,638	364,099	12	230	355,213
Washington	1905	482,263	125	13,575			804	159,505	501	4,225	304,958
	1900	283,218	307	27,785	3	1,300	446	61,155	956	6,060	186,918
West Virginia	1905	443,291	1,180	80,550	3	200	5,117	231,784	10	182	130,575
	1900	379,098	1,238	99,335	12	2,300	3,702	150,945	22	385	126,133
Wisconsin	1905	7,511,392	23,466	1,520,841	103	39,720	83,916	4,396,693	15,365	343,509	1,210,629
	1900	6,839,963	36,323	2,022,608	101	31,900	70,210	3,308,455	17,451	325,106	1,151,894
Wyoming [1]	1900	65,485	29	4,200			139	26,050			35,235
All other states	[2] 1905	43,745	26	2,660			170	20,305	1	42	20,738
	[3] 1900	11,445	47	4,295			5	350			6,800

[1] Included in "all other states" in 1905.
[2] Includes states as follows: Arizona, Indian Territory, Nevada, North Dakota, Wyoming.
[3] Includes states as follows: Indian Territory, Nevada.

In family and pleasure carriages, Ohio ranked first at the census of 1900, having produced 23.6 per cent of the number and 21.9 per cent of the value for the whole country. At the census of 1905, although still ranking first, the state produced only 21.3 per cent of the number and 20.4 per cent of the value. There was an absolute decline in number of 14,264, or 6.7 per cent, but an absolute increase in value of $115,984, or 1 per cent. Indiana reported a marked gain, advancing from third place in 1900 to second at the census of 1905, with an increase of 37,228, or 26.3 per cent, in number and of $2,734,932, or 39.3 per cent, in value.

Michigan ranked next to Indiana, with which it exchanged places during the intercensal period, but, like Ohio, showed a decrease in number, this decrease being 18,365, or 9.5 per cent, although there was a gain of $358,690, or 4.8 per cent, in value. Approximately three-fifths of the number and one-half of the value of family and pleasure carriages made were reported from these states at both censuses.

New York led in the number of public conveyances manufactured, with 27.4 per cent of the entire number reported at the census of 1905 and 29.6 per cent of that reported for 1900. The value for 1905 was $518,469, or 39.4 per cent of the total. Massachusetts was second for 1900, but Connecticut took its place at the census of 1905, with a value of $153,875. Michigan, which reported no public conveyances for 1900, reported 120, with a value of $116,026, at the census of 1905. Ohio and Pennsylvania showed large gains.

At each census the greatest number of wagons was manufactured in Indiana—14.4 per cent of the total at the census of 1905 and 16.5 per cent at the census of 1900. The reduced output reported for 1905 was due to a loss of 38.7 per cent in number of business wagons built, which more than counterbalanced the increase in farm wagons and in government and municipal wagons. The state also held first rank in farm wagons, with 15.5 per cent at the census of 1905 and 16.6 per cent for 1900.

Wisconsin was second at both censuses, the number reported for 1905 being a gain of 13,706, or 19.5 per cent. The value increased $1,088,238, or 32.9 per cent.

Two other states that occupied important positions in the manufacture of wagons were Illinois and Michigan. The total number built in the former state increased 15,669, or 27.8 per cent; in the latter state, 2,370, or 4.8 per cent. The increases in value were $888,617, or 28.3 per cent, in Illinois, and $303,498, or 14.8 per cent, in Michigan.

At the census of 1905 Michigan ranked first in the manufacture of sleighs and sleds, with an output of 41.7 per cent of the total number and 36.3 per cent of the total value. The increase in number was 2,031, or 4 per cent; and in value $131,057, or 15.5 per cent. New York ranked second at the census of 1905 with 15.2 per cent of the number and 22 per cent of the value. The increase was 4,933, or 34 per cent, in quantity and $180,693, or 43.8 per cent, in value.

Exports and imports.—The value of exports of carriages and wagons, and parts thereof, and the value of imports entered for consumption for each year ending June 30, from 1900 to 1905, are shown by the following tabular statement:

Exports and imports of carriages and wagons, and parts thereof: 1900 to 1905.[1]

YEAR ENDING JUNE 30—	Exports (value).	Imports entered for consumption (value).
1905	$3,320,641	$9,660
1904	3,354,801	18,337
1903	3,556,925	26,066
1902	2,490,063	19,640
1901	2,790,178	18,523
1900	2,809,784	29,662

[1] Bureau of Statistics, Department of Commerce and Labor, "Commerce and Navigation of the United States."

There was a loss in exports from 1900 to 1902, followed by a gain for 1903, when the maximum was reached, yet the total value for 1905 was $510,857 more than that for 1900, an increase of 18.2 per cent. The proportion of the total output exported was about the same for 1905 as for 1900, the percentages being 2.7 for the former year and 2.5 for the latter, a very slight gain.

For 1905, 17.8 per cent of the total exports went to the United Kingdom; this was a decrease of $231,888, or 28.2 per cent from 1900. The decrease in the exports to the other European countries, however, was 55.6 per cent. For 1900 the greatest amount exported to the North American continent was to Mexico, but for 1905 the predominant exportation was to the Dominion of Canada, although the trade with Mexico showed a healthy growth. Argentina afforded the best South American market for both 1900 and 1905, 83.1 per cent of the value of exports to South America for 1905 and 76.9 per cent for 1900 going to that country. These exports to Argentina increased from $178,621 for 1900 to $457,587 for 1905, a gain of $278,966, or 156.2 per cent. The East Indies outranked all other countries of Asia for 1900 as well as 1905, but Japan showed the largest value for any single country for 1905. British Australasia was the leading country of Oceania in both years, and British Africa, the principal subdivision of Africa to which carriages and wagons were exported.

The imports are insignificant, and the decrease since 1900 has been $20,002, or 67.4 per cent.

Carriage and wagon materials.—In the report for the census of 1900 the statement was made that in the earliest stages of the carriage and wagon industry almost the entire work of manufacturing was done at the establishment, but that in 1900 there were very few, if any, manufacturers who produced all the parts. The manufacture of carriage and wagon materials as a separate industry has been steadily growing. Table 6 is a comparative summary of the general statistics for this industry at the censuses of 1890, 1900, and 1905.

TABLE 6.—*Carriage and wagon materials—comparative summary: 1890 to 1905.*

	1905	1900	1890
Number of establishments	632	588	539
Capital	$26,024,053	$19,085,775	$13,028,161
Wage-earners, average number	17,160	15,387	9,996
Total wages	$7,484,450	$5,987,267	$4,366,233
Miscellaneous expenses	$1,930,469	$1,202,666	$821,743
Cost of materials used	$16,312,683	$13,048,608	$7,387,904
Value of products	$30,535,873	$25,027,173	$16,262,293

Every item of the table shows a substantial increase at each census. The increase in total wages was $1,621,034, or 37 per cent, from 1890 to 1900 and $1,497,183, or 25 per cent, from 1900 to 1905. The increase in value of products was $8,764,880, or 53.9 per cent, from 1890 to 1900 and $5,508,700, or 22 per cent, from 1900 to 1905.

A comparison of gains in carriage and wagon materials from census to census with those shown in Table 1 for carriages and wagons shows that the value of products increased more rapidly in the former than in the latter industry. In 1890 the combined products were valued at $118,942,634, of which the value of carriage and wagon materials constituted 13.7 per cent; for 1900 the combined products were valued at $138,261,763, and carriage and wagon materials formed 18.1 per cent thereof, and for 1905 the combined products were valued at $155,868,849, to which carriage and wagon materials contributed 19.6 per cent. The entire product of the carriage and wagon material factories, however, is not disposed of to carriage and wagon manufacturers; blacksmiths and wheelwrights use a part of the products in their custom and repair work.

The detailed statistics for the carriage and wagon industry as reported at the census of 1905 are shown, by states and territories, in Table 7.

TABLE 7.—CARRIAGES AND WAGONS—DETAILED

		United States.	Alabama.	Arkansas.	California.	Colorado.
1	Number of establishments	4,956	23	16	184	35
2	Capital, total	$126,320,604	$558,163	$314,919	$1,676,158	$262,888
3	Land	$10,867,701	$30,025	$37,800	$354,140	$60,800
4	Buildings	$23,186,108	$75,103	$43,804	$232,150	$57,600
5	Machinery, tools, and implements	$11,785,633	$80,952	$42,914	$268,598	$35,965
6	Cash and sundries	$80,481,162	$372,083	$190,401	$821,270	$108,523
7	Proprietors and firm members	6,022	27	15	236	39
	Salaried officials, clerks, etc.:					
8	Total number	5,058	28	12	47	9
9	Total salaries	$5,239,043	$28,021	$8,373	$48,675	$8,900
	Officers of corporations—					
10	Number	866	6	1	12	2
11	Salaries	$1,598,251	$10,780	$900	$20,794	$2,500
	General superintendents, managers, clerks, etc.—					
12	Total number	4,192	22	11	35	7
13	Total salaries	$3,640,792	$17,241	$7,473	$27,881	$6,400
	Men—					
14	Number	3,443	21	9	28	6
15	Salaries	$3,306,893	$16,641	$6,745	$25,148	$6,300
	Women—					
16	Number	749	1	[illegible]	7	1
17	Salaries	$333,899	$600	$728	$2,733	$100
	Wage-earners, including pieceworkers, and total wages:					
18	Greatest number employed at any one time during the year	74,698	459	170	1,168	200
19	Least number employed at any one time during the year	48,436	207	115	810	157
20	Average number	60,722	370	134	938	177
21	Total wages	$30,878,229	$161,399	$60,898	$684,812	$129,557
	Men 16 years and over—					
22	Average number	59,411	350	132	932	171
23	Wages	$30,525,515	$157,828	$60,598	$683,157	$128,309
	Women 16 years and over—					
24	Average number	870			1	
25	Wages	$266,674			$100	
	Children under 16 years—					
26	Average number	441	20	2	5	6
27	Wages	$86,040	$3,571	$300	$1,555	$1,248
	Average number of wage-earners, including pieceworkers, employed during each month:					
	Men 16 years and over—					
28	January	56,908	303	118	843	155
29	February	58,931	347	117	856	155
30	March	62,282	346	119	893	165
31	April	64,026	297	124	932	171
32	May	64,022	274	129	998	182
33	June	63,366	341	133	1,033	185
34	July	60,943	371	145	1,044	183
35	August	57,999	388	150	1,026	178
36	September	57,403	386	149	970	179
37	October	55,918	403	139	909	175
38	November	55,191	379	134	855	167
39	December	55,943	365	127	825	157
	Women 16 years and over—					
40	January	930			1	
41	February	985			1	
42	March	1,012			1	
43	April	1,005			1	
44	May	979			1	
45	June	942			1	
46	July	833			1	
47	August	746			1	
48	September	748			1	
49	October	722			1	
50	November	736			1	
51	December	802			1	
	Children under 16 years—					
52	January	409	18	2	5	6
53	February	414	19	2	4	6
54	March	440	20	2	4	6
55	April	450	17	2	5	6
56	May	452	13	2	6	6
57	June	474	20	2	6	6
58	July	466	21	2	6	6
59	August	474	24	2	5	6
60	September	446	24	2	5	6
61	October	434	22	2	5	6
62	November	416	22	2	4	6
63	December	417	20	2	5	6
64	Miscellaneous expenses, total	$10,182,614	$77,199	$12,872	$169,439	$21,262
65	Rent of works	$1,144,392	$6,100	$1,093	$58,357	$8,174
66	Taxes	$703,752	$3,090	$2,271	$9,759	$2,569
67	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$8,150,715	$68,009	$9,023	$87,281	$9,719
68	Contract work	$183,755		$485	$14,042	$800
69	Materials used, total cost	$61,215,228	$369,470	$70,219	$789,413	$132,648
70	Lumber	$10,338,003	$96,076	$18,139	$149,153	$20,935
71	Iron and steel	$9,854,548	$61,478	$15,905	$188,819	$32,763
72	Carriage hardware, lamps, and mountings	$5,219,958	$8,373	$7,080	$59,309	$4,680
73	Paints, oils, turpentine, and varnish	$3,900,273	$31,202	$4,370	$42,317	$12,205
74	Enamel, rubber, and other carriage cloth	$3,398,921	$3,223	$2,292	$17,783	$2,670
75	Leather	$3,867,480	$2,659	$1,378	$12,038	$1,545
76	Rubber tires	$2,626,889	$11,350	$5,389	$39,495	$7,204
	Carriage bodies, purchased—					
77	Number	485,879	451	26	203	64
78	Cost	$2,059,426	$1,835	$101	$3,151	$1,229
	Gears, purchased—					
79	Number	126,082	458	14	577	123
80	Cost	$562,489	$2,027	$290	$14,926	$1,392
	Wagon bodies, purchased—					
81	Number	32,319	7		176	50
82	Cost	$208,058	$70		$3,321	$695
	Tops, purchased—					
83	Number	22,426	219	49	498	84
84	Cost	$168,922	$1,802	$508	$5,706	$861
	Wheels, purchased—					
85	Number	3,628,889	5,622	1,507	22,208	5,627
86	Cost	$5,863,931	$13,090	$3,323	$80,741	$14,743
87	Axles and springs, purchased	$4,460,759	$11,250	$2,549	$77,823	$10,503

SUMMARY, BY STATES AND TERRITORIES: 1905.

Connecticut.	Delaware.	District of Columbia.	Florida.	Georgia.	Illinois.	Indiana.	Iowa.	Kansas.	Kentucky.	
96	21	6	31	75	290	188	97	38	102	1
$2,087,840	$264,783	$50,117	$222,127	$1,508,958	$10,838,860	$22,276,315	$3,107,725	$324,166	$4,225,145	2
$239,655	$46,315	$22,500	$55,775	$133,532	$1,063,686	$674,960	$171,276	$32,100	$286,341	3
$423,460	$75,085	$12,700	$38,150	$206,093	$2,140,279	$4,571,858	$357,560	$72,625	$735,835	4
$196,592	$25,930	$6,800	$32,758	$185,897	$976,613	$1,602,747	$241,323	$31,105	$301,518	5
$1,228,133	$117,453	$8,117	$95,444	$983,436	$6,658,282	$15,426,750	$2,337,566	$188,336	$2,901,451	6
108	28	6	42	91	338	198	120	53	120	7
82	8	1	9	87	401	796	175	12	163	8
$110,508	$5,260	$1,560	$6,010	$96,786	$466,781	$808,928	$176,950	$9,280	$163,350	9
24				23	81	100	26	3	20	10
$44,497				$40,842	$160,670	$217,647	$46,200	$3,600	$47,422	11
58	8	1	9	64	320	696	149	9	143	12
$66,011	$5,260	$1,560	$6,010	$55,944	$306,111	$591,281	$130,750	$5,680	$115,928	13
49	8	1	9	56	258	558	128	7	118	14
$61,973	$5,260	$1,560	$6,010	$51,864	$276,724	$529,699	$120,211	$4,680	$105,568	15
9				8	62	138	21	2	25	16
$4,038				$4,080	$29,387	$61,582	$10,539	$1,000	$10,360	17
1,649	186	72	247	1,350	5,125	8,788	1,458	260	2,117	18
1,205	117	36	167	863	3,014	5,544	850	184	1,481	19
1,372	137	52	196	1,115	4,186	7,156	1,103	214	1,812	20
$690,185	$68,992	$25,249	$101,890	$426,484	$2,320,141	$3,254,027	$528,016	$105,168	$800,331	21
1,370	136	51	193	1,094	4,123	6,854	1,088	212	1,750	22
$689,655	$68,885	$24,937	$101,418	$421,160	$2,300,365	$3,172,498	$522,503	$104,794	$787,598	23
2				5	50	225	14	1	23	24
$530				$2,050	$16,206	$63,106	$5,213	$150	$5,024	25
	1	1	3	16	13	77	1	1	39	26
	$107	$312	$472	$3,274	$3,570	$18,423	$300	$224	$7,709	27
1,314	124	38	190	1,035	3,787	7,956	981	183	1,698	28
1,315	131	39	190	1,029	3,903	7,427	1,071	187	1,688	29
1,356	141	41	192	1,058	4,385	7,719	1,140	211	1,771	30
1,419	150	46	187	1,088	4,485	7,633	1,208	231	1,826	31
1,435	152	60	186	1,004	4,507	7,509	1,188	230	1,831	32
1,463	150	67	193	1,031	4,418	7,201	1,184	230	1,877	33
1,385	144	69	196	1,119	4,334	6,646	1,170	238	1,791	34
1,327	136	68	197	1,162	4,222	6,171	1,150	234	1,815	35
1,337	132	64	190	1,186	4,036	6,124	1,055	218	1,775	36
1,371	126	45	192	1,146	3,876	6,059	1,002	202	1,658	37
1,329	122	38	200	1,133	3,617	6,167	964	193	1,626	38
1,389	124	37	203	1,137	3,906	6,536	943	187	1,644	39
3				4	51	260	13	1	24	40
2				5	52	271	15	1	26	41
3				5	56	274	16	1	26	42
2				5	55	264	18	1	28	43
3				3	56	249	18	1	25	44
2				3	53	244	14	1	25	45
2				4	52	208	14	1	24	46
1				6	53	180	12	1	23	47
2				7	47	180	12	1	24	48
1				6	42	176	12	1	19	49
2				6	43	182	13	1	13	50
1				6	40	212	11	1	19	51
		1	3	14	15	72		1	38	52
		1	3	14	17	76		1	38	53
	1	1	3	17	17	83		1	43	54
	1	1	3	16	15	88		1	44	55
	1	1	3	10	15	80	1	1	46	56
	2	1	3	12	16	78	1	1	41	57
	2	1	3	16	15	75	6	1	36	58
	1	1	3	17	15	74	4	1	36	59
	1	1	3	18	10	77		1	36	60
	1	1	3	20	10	75		1	36	61
	1	1	3	18	5	76		1	37	62
	1	1	3	20	6	75		1	37	63
$104,042	$15,504	$4,873	$27,279	$137,456	$844,469	$1,173,980	$424,778	$26,290	$354,043	64
$23,085	$3,883	$2,100	$6,539	$9,868	$119,376	$36,198	$18,874	$2,688	$8,723	65
$12,635	$1,319	$610	$1,797	$10,469	$56,795	$93,138	$15,677	$2,408	$22,141	66
$64,740	$10,102	$2,163	$13,443	$117,119	$659,122	$1,039,175	$389,062	$21,039	$316,526	67
$3,582	$200		$5,500		$9,176	$5,469	$1,165	$155	$6,653	68
$666,068	$102,352	$21,776	$124,177	$1,222,149	$4,885,773	$8,598,170	$1,479,085	$116,724	$2,089,687	69
$86,062	$13,577	$2,400	$15,032	$122,593	$1,253,071	$1,642,259	$357,802	$18,222	$648,939	70
$108,636	$13,262	$9,750	$17,965	$227,410	$1,069,724	$1,245,521	$233,632	$21,656	$449,247	71
$50,375	$10,344	$100	$5,500	$94,367	$309,234	$749,775	$105,356	$7,461	$188,910	72
$50,674	$8,365	$3,000	$9,757	$79,468	$274,608	$484,442	$73,296	$9,619	$145,451	73
$34,980	$14,258	$435	$3,735	$40,270	$233,085	$521,713	$88,178	$5,558	$47,236	74
$36,860	$4,114	$350	$4,965	$117,212	$235,174	$672,989	$113,300	$4,455	$54,057	75
$44,081	$4,613	$250	$7,320	$30,712	$153,023	$365,381	$31,682	$7,097	$128,351	76
936	82		490	8,771	24,465	95,960	12,372	123	12,039	77
$12,582	$2,137		$2,177	$33,216	$118,718	$362,035	$46,514	$701	$43,952	78
1,246	34		549	303	13,735	7,781	269	53	225	79
$9,681	$403		$3,448	$2,041	$19,773	$45,612	$1,940	$984	$1,172	80
120	12		6	95	249	2,740	65	1	69	81
$1,050	$540		$27	$628	$3,892	$14,955	$616	$25	$637	82
86	4	3	155	581	514	1,880	663	151	102	83
$1,092	$60	$36	$1,451	$4,851	$4,886	$14,606	$4,887	$1,336	$1,111	84
17,250	8,008	458	13,192	125,862	215,131	495,848	62,693	7,608	74,977	85
$53,760	$11,675	$2,525	$26,042	$230,532	$379,238	$678,899	$104,586	$15,285	$129,680	86
$47,673	$13,773	$850	$11,949	$111,609	$248,834	$577,250	$74,317	$13,800	$94,199	87

TABLE 7.—CARRIAGES AND WAGONS—DETAILED

		United States.	Alabama.	Arkansas.	California.	Colorado.
	Materials used—Continued.					
88	Fuel	$1,175,035	$4,266	$2,057	$35,383	$7,993
89	Rent of power and heat	$180,470	$570	$360	$13,255	$1,271
90	Mill supplies	$225,667	$2,061	$313	$3,145	$442
91	All other materials	$6,146,166	$85,574	$6,020	$32,203	$10,192
92	Freight	$958,233	$32,564	$145	$10,845	$1,325
93	Products, total value	$125,332,976	$720,282	$189,914	$2,220,486	$379,368
	Family and pleasure carriages—					
94	Number	937,409	504	35	2,160	203
95	Value	$55,750,276	$36,657	$2,045	$216,250	$25,100
	Public conveyances—					
96	Number	2,711	2		42	
97	Value	$1,314,952	$490		$18,454	
	Wagons (business, farm, government, municipal, etc.)—					
98	Number	643,755	12,512	1,625	3,045	750
99	Value	$37,195,230	$527,987	$102,736	$502,503	$113,354
	Sleighs and sleds—					
100	Number	127,455			13	43
101	Value	$2,694,560			$431	$1,990
	Automobiles—					
102	Number	199				
103	Value	$235,675				
104	Parts manufactured, not elsewhere included	$708,176	$2,343	$3,453	$21,695	$660
105	All other products	$3,285,678	$4,576	$1,645	$68,340	$5,360
106	Amount received for repair work	$24,148,429	$148,229	$80,035	$1,392,813	$232,904
	Kind and quantity of products:					
107	Family and pleasure carriages, aggregate number	937,409	504	35	2,160	203
108	Two-wheeled, total number	29,544	2		1,057	53
109	Cars	456	2		21	
110	Carts	27,743			1,021	42
111	Gigs	83			2	
112	Sulkies	1,139			13	11
113	Tandems	43				
114	Other	80				
115	Four-wheeled, for one or two persons, total number	769,635	417	27	896	144
116	Buggies	575,880	343	22	470	71
117	Buckboards	6,732			59	
118	Driving wagons	47,118		5	21	49
119	Park wagons	1,935			5	
120	Phaetons	12,982	33		17	
121	Pony wagons	4,637			3	
122	Road wagons	50,527	20		80	4
123	Runabouts	53,813	15		231	20
124	Spiders	405				
125	Stanhopes	9,585	6		7	
126	Traps	1,516			2	
127	Other	4,504			1	
128	Four-wheeled, for three or more persons, total number	138,230	85	8	207	6
129	Brakes	193			3	
130	Broughams	933			10	
131	Buckboards	2,068			9	
132	Cabriolets	1,394				
133	Coupes	222				
134	Landaus	480			5	
135	Mountain wagons	3,462	30	8	46	2
136	Park wagons	2,872			1	
137	Phaetons	1,091	25		4	
138	Road wagons	14,328			51	
139	Rockaways	2,324			1	
140	Spiders	63				
141	Surreys	87,464	30		56	2
142	Tallyhos	30				
143	Traps	1,412			4	2
144	Victorias	327				
145	Vis-a-vis	71				
146	Other	19,496			17	
147	Public conveyances, total number	2,711	2		42	
148	Cabs	174			3	
149	Hacks	1,619	1		7	
150	Hansoms	95				
151	Hotel coaches	352			2	
152	Omnibuses	269	1		5	
153	Other	202			25	
154	Business wagons, total number	133,422	593	544	2,680	722
155	Baggage transfer wagons	2,455		5	106	12
156	Caravans	364			1	
157	Coal wagons and carts	3,253	21	10	42	66
158	Delivery wagons	60,376	408	64	1,470	350
159	Drays	2,856	79	1	42	7
160	Dump dirt wagons and carts	6,417	5	2	109	2
161	Express wagons	7,853		46	224	229
162	Furniture vans	419	8		11	2
163	Furniture wagons	1,049	14	14	44	5
164	Garbage wagons and carts	348	5		33	
165	Handcarts	6,089	3	8	55	
166	Hearses	642		1	2	
167	Ice wagons	1,123	8	4	30	10
168	Log wagons	4,644	33	212	1	8
169	Ore wagons	129				15
170	Street sprinklers	109			6	
171	Street sweepers	48				
172	Trucks	12,403	1	120	181	1
173	Other	22,845	8	57	323	20
174	Wagons (government, municipal, etc.), total number	5,308	2	3	13	2
175	Ambulances	245			5	
176	Fire patrol wagons	51			1	
177	Hose wagons	251		2	2	1
178	Mail and mail carriers' wagons and carts	4,703	2	1	3	1
179	Police patrol wagons	55			2	
180	Prison vans	3				
181	Farm wagons, total number	505,025	11,917	1,078	352	26
182	One-horse	82,619	4,473	31	52	
183	Two-horse	379,441	7,431	1,042	178	26
184	Mountain	22,104			33	
185	Dump carts or farm trucks	20,861	13	5	89	

SUMMARY, BY STATES AND TERRITORIES: 1905—Continued.

Connecticut.	Delaware.	District of Columbia.	Florida.	Georgia.	Illinois.	Indiana.	Iowa.	Kansas.	Kentucky.	
$27,610	$1,036	$850	$2,914	$12,391	$89,367	$158,819	$25,050	$4,162	$28,006	88
$1,874	$525	$75	$566	$3,710	$20,478	$13,608	$2,978	$578	$2,480	89
$2,179	$27	$40	$67	$4,376	$24,980	$27,078	$3,618	$273	$18,313	90
$87,931	$2,528	$950	$10,077	$66,671	$373,685	$940,371	$178,558	$4,557	$102,156	91
$8,968	$1,115	$75	$1,185	$40,092	$74,003	$82,857	$32,775	$955	$5,790	92
$1,909,483	$228,350	$75,265	$344,481	$2,303,196	$9,798,965	$15,228,337	$2,974,043	$320,768	$4,059,438	93
2,381	1,219		415	20,919	56,075	178,962	16,498	533	27,195	94
$753,306	$104,663		$29,200	$1,210,122	$3,730,173	$9,694,829	$1,113,064	$29,446	$1,302,914	95
179	1		12	39	70	63	98	16	1	96
$153,875	$200		$2,350	$4,825	$19,705	$11,180	$8,250	$3,805	$225	97
1,944	695	99	2,652	18,848	72,033	92,893	22,815	1,004	49,266	98
$224,365	$57,312	$22,165	$125,810	$794,491	$4,027,545	$4,288,664	$1,426,015	$117,878	$2,332,327	99
383	3				5,007	1,378	2,766		4	100
$18,643	$38				$48,293	$27,149	$46,187		$41	101
				1	1	92	1			102
				$600	$1,000	$117,516	$1,300			103
$63,564	$202	$200	$2,955	$2,832	$28,499	$111,643	$40,397	$588	$6,599	104
$72,623	$1,706	$25	$17,990	$21,550	$330,734	$378,862	$34,065	$9,550	$17,549	105
$623,107	$64,229	$52,875	$166,176	$268,776	$1,613,016	$598,494	$304,765	$159,501	$399,783	106
2,381	1,219		415	20,919	56,075	178,962	16,498	533	27,195	107
46				2	7,224	3,830	37	27	450	108
					10	40				109
31				2	7,038	3,788	17	26	450	110
14										111
					171		20	1		112
1					4					113
					1	2				114
1,399	955		376	20,857	40,702	143,164	14,031	154	24,926	115
516	763		369	19,840	34,230	109,890	12,232	92	18,052	116
82			2	20	286	467	5		72	117
191	19		3	80	1,377	13,767	839	8	2,614	118
25	1				92	50	5		5	119
54	12			88	355	2,845	67	7	408	120
				3	90	296	8		18	121
11	6			160	1,843	8,893	575	16	2,500	122
264	146		2	604	1,531	4,607	170	27	1,037	123
17				1	13	75	1		8	124
75	3			30	439	1,451	114	4	211	125
17				11	279	152				126
147	5			20	167	671	15		1	127
930	264		39	60	8,149	31,968	2,430	352	1,819	128
33					17		6			129
173				1	62	2	10		1	130
			3		2	143		10		131
130					27	200		1		132
72					37		1			133
73					164		28			134
5					124	1,360		200		135
4					507	404	11	20	6	136
157	9			7	1	30		25	101	137
2	15			4	306	5,045	323		19	138
79	82			10	33	59	11		25	139
18						5				140
109	137		35	34	6,343	22,202	1,710	89	1,598	141
10					2		5			142
13	2		1		78	289			22	143
15				4	42	14				144
17					2					145
26	19				402	2,215	325	7	47	146
179	1		12	39	70	63	98	16	1	147
25					5					148
107	1		2	28	19	35	40			149
14				11	10					150
17					32		25	6		151
15			10		3		33	2		152
1					1	28		8	1	153
1,756	614	97	1,147	1,241	6,195	12,554	787	934	2,123	154
52	1		27	39	159	178	98	145	16	155
					1		3	1		156
77	2	6	14	51	131	145	34	28	206	157
822	583	23	760	299	2,735	9,078	216	566	388	158
48			80	217	37	100	161	32	154	159
219	13		77	9	161	48	20		59	160
254	11	3	18	53	766	173	66	59	23	161
1	1		7	18	8	20	9		5	162
26	1	2	6	16	83	57	9	17	6	163
16		60		13	7					164
4	1		2	36	265	527		2		165
					5	2		1		166
18			5	18	72	50	17	10	14	167
22			125	87	136	151	2	2	1,177	168
5					65					169
5			1		26	1			1	170
						5				171
152			25	46	220	160	25	1	35	172
35	1	3		339	1,318	1,859	127	70	39	173
3		2	5	18	493	1,999	32	12	16	174
					10	6	12	3		175
2				2	1	2			5	176
1			1	5	8	3			3	177
		2	3	9	468	1,985	14	9	8	178
			1	2	6	3	5			179
										180
185	81		1,500	17,589	65,345	78,340	21,996	58	47,127	181
56	50		1,095	10,032	4,488	8,236	624	5	7,477	182
99	27		380	7,501	51,401	64,453	14,032	51	39,051	183
10				15	3,920	4,210	6,044		341	184
20	4		25	41	5,536	1,441	1,296	2	258	185

TABLE 7.—CARRIAGES AND WAGONS—DETAILED

		United States.	Alabama.	Arkansas.	California.	Colorado.
	Kind and quantity of products—Continued.					
186	Sleighs, total number	127,455			13	43
187	One-seated	67,048			2	
188	Two-seated	6,972				22
189	Speeding or racing	1,438				
190	Sleds, horse, including "bobs"	51,997			11	21
191	Automobiles, total number	199				
192	Runabout	101				
193	Touring	58				
194	Surrey	14				
195	Phaeton	1				
196	Doctor's wagon or car	2				
197	Delivery, light	5				
198	Delivery, heavy	6				
199	Other	12				
	Parts manufactured, not elsewhere included—					
200	Carriage bodies	8,676		6	104	15
201	Wagon bodies	8,855		94	413	3
202	Tops	14,555		56	361	4
203	Wheels	389,266		369	769	200
	Power:					
204	Number of establishments reporting	2,235	8	11	112	16
205	Total horsepower	68,495	459	321	724	84
	Owned—					
	Engines—					
	Steam—					
206	Number	932	7	11	5	1
207	Horsepower	44,447	406	296	43	10
	Gas and gasoline—					
208	Number	790	4	1	36	2
209	Horsepower	7,549	33	5	237	8
	Water wheels—					
210	Number	89			4	
211	Horsepower	2,337			22	
	Water motors—					
212	Number	20			4	
213	Horsepower	80			2	
	Electric motors—					
214	Number	359				
215	Horsepower	5,471				
216	Other power, horsepower	47				
	Rented—					
	Electric motors—					
217	Number	1,115	2	2	94	17
218	Horsepower	7,883	20	20	420	66
219	Other kind, horsepower	681				
220	Furnished to other establishments, horsepower	217				

SUMMARY, BY STATES AND TERRITORIES: 1905—Continued.

Connecticut.	Delaware.	District of Columbia.	Florida.	Georgia.	Illinois.	Indiana.	Iowa.	Kansas.	Kentucky.	
383	3				5,007	1,378	2,766		4	186
77					18	329	1,043		4	187
165					8	1	7			188
28						4	10			189
113	3				4,981	1,044	1,706			190
				1	1	92	1			191
					1	70				192
						17				193
							1			194
										195
				1						196
										197
										198
						5				199
71	3		11	5	25	32	156		183	200
64	8	5	35	121	713	196	973	18	84	201
	5	10	12	74	592	101	1,549	20	502	202
13,637		80	2,200	606	746	81,020	58		277	203
44	9	2	10	35	157	103	52	10	37	204
903	104	57	169	1,251	5,752	9,708	1,513	96	3,255	205
21	2	1	3	22	52	70	21	3	31	206
465	20	25	125	916	3,805	6,050	1,170	55	2,586	207
16	4	1	4	5	48	42	25	4	10	208
145	34	25	14	29	413	602	177	23	68	209
7				1	4					210
167				8	270					211
1									1	212
3									16	213
				11	16	116	1		19	214
				141	341	2,440	50		468	215
										216
8	4	2	4	14	154	62	23	3	12	217
103	50	7	30	117	916	604	116	18	117	218
20				40	7	12				219
10				21	10			8		220

TABLE 7.—CARRIAGES AND WAGONS—DETAILED

		Louisiana.	Maine.	Maryland.	Massachusetts.	Michigan.	Minnesota.
1	Number of establishments	40	154	111	280	183	134
2	Capital, total	$236,770	$660,764	$898,874	$3,813,839	$9,264,093	$2,159,885
3	Land	$53,610	$52,275	$60,650	$381,254	$500,475	$197,040
4	Buildings	$44,410	$170,800	$276,333	$534,159	$1,382,093	$414,244
5	Machinery, tools, and implements	$45,155	$92,736	$103,970	$445,535	$644,356	$267,577
6	Cash and sundries	$93,595	$344,953	$457,921	$2,452,891	$6,737,169	$1,281,024
7	Proprietors and firm members	46	181	148	343	204	171
	Salaried officials, clerks, etc.:						
8	Total number	11	14	31	120	514	74
9	Total salaries	$10,576	$11,499	$17,966	$109,140	$493,523	$79,516
	Officers of corporations—						
10	Number	5	5	9	17	75	15
11	Salaries	$7,140	$6,720	$6,772	$32,620	$160,196	$29,700
	General superintendents, managers, clerks, etc.—						
12	Total number	6	9	22	103	439	59
13	Total salaries	$3,436	$4,779	$11,194	$76,520	$333,327	$49,816
	Men—						
14	Number	6	6	20	70	348	54
15	Salaries	$3,436	$3,815	$10,790	$64,285	$291,983	$47,446
	Women—						
16	Number	....	3	2	33	91	5
17	Salaries	....	$964	$404	$12,235	$41,344	$2,370
	Wage-earners, including pieceworkers, and total wages:						
18	Greatest number employed at any one time during the year	350	613	934	2,873	6,085	1,153
19	Least number employed at any one time during the year	251	376	641	1,764	3,446	739
20	Average number	293	451	774	2,232	4,688	872
21	Total wages	$159,317	$243,578	$347,236	$1,367,349	$2,246,493	$424,777
	Men 16 years and over—						
22	Average number	291	450	770	2,211	4,570	869
23	Wages	$159,011	$243,110	$346,688	$1,358,979	$2,206,708	$423,977
	Women 16 years and over—						
24	Average number	....	1	....	20	114	2
25	Wages	....	$468	....	$8,120	$38,425	$642
	Children under 16 years—						
26	Average number	2	....	4	1	4	1
27	Wages	$306	....	$548	$250	$1,360	$158
	Average number of wage-earners, including pieceworkers, employed during each month:						
	Men 16 years and over—						
28	January	291	420	646	2,023	4,695	909
29	February	277	431	657	2,072	4,924	914
30	March	285	462	711	2,288	5,254	911
31	April	281	498	809	2,548	5,354	871
32	May	277	494	863	2,590	5,157	859
33	June	284	485	888	2,542	4,850	874
34	July	289	449	876	2,313	4,103	873
35	August	298	426	844	2,134	3,858	859
36	September	304	440	812	2,069	4,000	823
37	October	303	437	750	1,966	4,040	864
38	November	304	430	705	1,960	4,180	839
39	December	290	428	679	2,027	4,425	832
	Women 16 years and over—						
40	January	....	1	....	20	131	1
41	February	....	1	....	20	138	1
42	March	....	1	....	24	138	1
43	April	....	1	....	24	135	1
44	May	....	1	....	22	135	2
45	June	....	1	....	21	114	2
46	July	....	1	....	20	90	2
47	August	....	1	....	17	84	2
48	September	....	1	....	19	87	3
49	October	....	1	....	18	96	3
50	November	....	1	....	17	106	3
51	December	....	1	....	18	114	3
	Children under 16 years—						
52	January	2	....	4	1	5	....
53	February	2	....	4	1	5	....
54	March	2	....	4	1	5	1
55	April	2	....	4	1	5	1
56	May	2	....	4	1	5	1
57	June	2	....	4	1	4	2
58	July	2	....	4	1	2	2
59	August	2	....	4	1	2	2
60	September	2	....	4	1	3	....
61	October	2	....	4	1	4	1
62	November	2	....	4	1	4	1
63	December	2	....	4	1	4	1
64	Miscellaneous expenses, total	$17,862	$44,061	$63,496	$336,954	$933,855	$135,948
65	Rent of works	$5,398	$7,101	$17,801	$90,749	$18,568	$14,123
66	Taxes	$981	$4,995	$6,358	$24,865	$75,494	$11,551
67	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$11,483	$23,364	$36,382	$203,621	$817,252	$108,250
68	Contract work	....	$8,601	$2,955	$17,719	$22,541	$2,024
69	Materials used, total cost	$151,365	$392,280	$487,231	$1,656,271	$7,005,109	$781,727
70	Lumber	$25,342	$58,858	$65,925	$145,432	$693,879	$309,583
71	Iron and steel	$27,068	$100,026	$85,304	$258,505	$787,344	$223,553
72	Carriage hardware, lamps, and mountings	$16,173	$32,429	$50,402	$160,961	$589,038	$14,501
73	Paints, oils, turpentine, and varnish	$10,421	$22,853	$41,647	$132,833	$385,998	$45,495
74	Enamel, rubber, and other carriage cloth	$4,944	$19,112	$27,311	$159,989	$432,033	$5,588
75	Leather	$3,074	$16,052	$16,627	$113,380	$326,248	$13,959
76	Rubber tires	$4,333	$14,871	$21,351	$128,393	$290,532	$10,976
	Carriage bodies, purchased—						
77	Number	95	366	1,507	2,999	105,840	179
78	Cost	$429	$3,918	$11,170	$38,028	$412,996	$1,116
	Gears, purchased—						
79	Number	98	317	1,064	6,410	14,167	506
80	Cost	$1,072	$1,161	$12,684	$36,540	$52,459	$4,468
	Wagon bodies, purchased—						
81	Number	20	176	212	708	13,698	17
82	Cost	$200	$1,155	$3,034	$11,286	$59,921	$221
	Tops, purchased—						
83	Number	132	131	141	116	1,560	225
84	Cost	$957	$886	$1,902	$2,034	$8,902	$1,951
	Wheels, purchased—						
85	Number	5,410	19,571	16,757	41,457	640,634	19,683
86	Cost	$18,870	$49,240	$48,336	$136,232	$808,259	$33,657
87	Axles and springs, purchased	$19,126	$33,569	$36,062	$113,377	$574,228	$21,148

SUMMARY, BY STATES AND TERRITORIES: 1905—Continued.

Mississippi.	Missouri.	Montana.	Nebraska.	New Hampshire.	New Jersey.	New Mexico.	New York.	North Carolina.	Ohio.	
12	222	6	17	39	200	4	590	125	348	1
$303,120	$4,876,917	$60,258	$202,933	$814,372	$2,545,445	$61,050	$13,962,721	$2,010,457	$12,980,183	2
$36,574	$344,262	$9,000	$55,700	$99,460	$458,570	$9,050	$1,724,141	$95,835	$885,593	3
$30,721	$655,176	$3,100	$42,800	$209,295	$665,088	$9,500	$2,612,456	$263,575	$2,130,062	4
$49,990	$391,796	$17,422	$26,281	$87,256	$286,523	$5,500	$1,378,529	$195.275	$1,032,288	5
$185,835	$3,485,683	$30,736	$78,152	$418,361	$1,135,264	$37,000	$8,247,595	$1,455,772	$8,932,240	6
11	274	8	22	45	229	6	718	160	430	7
17	260	6	11	16	76	2	490	64	741	8
$17,244	$285,791	$6.000	$8,823	$20,650	$86,541	$1,920	$604,819	$59,628	$707,490	9
3	77	2	1	3	17		72	24	108	10
$4,500	$113,393	$2,100	$1,500	$8,000	$29,646		$156,358	$21.760	$196,462	11
14	183	4	10	13	59	2	418	40	633	12
$12,744	$172,398	$3,900	$7,323	$12,650	$56,895	$1,920	$448,461	$37,868	$511,028	13
14	155	3	7	10	55	2	365	36	484	14
$12,744	$157,301	$3,600	$5,903	$11,010	$55,419	$1,920	$423,476	$36,466	$449,905	15
	25	1	3	3	4		53	4	149	16
	$15,097	$300	$1,420	$1,640	$1,476		$24,985	$1,402	$61,123	17
194	3,356	30	191	433	1,916	32	8.079	1,658	8,865	18
159	2,014	19	106	343	1,404	21	5,321	1,176	5,234	19
171	2,636	23	144	382	1,638	26	6.789	1,373	6,768	20
$74,953	$1,477,540	$19,900	$83,155	$229,624	$960,903	$19,947	$3,936,924	$481,528	$3,335,551	21
169	2,582	22	142	381	1,634	26	6,719	1,292	6,548	22
$74,693	$1,459,470	$19,750	$82,789	$229,174	$960,175	$19,947	$3,918,222	$466,607	$3,267,028	23
	47			1	1		57	11	218	24
	$16,654			$450	$260		$16,201	$2,476	$68,067	25
2	7	1	2		3		13	70	2	26
$260	$1,416	$150	$366		$468		$2,501	$12,445	$456	27
176	2,327	20	123	377	1,496	25	6,330	1,192	6,394	28
166	2,499	20	136	383	1,519	27	6,637	1,211	6,738	29
167	2,774	20	142	399	1,601	27	6,951	1,242	7,106	30
172	2,878	21	164	412	1,712	27	7,147	1,292	7,462	31
174	2,960	23	176	415	1,712	27	6,900	1,324	7,529	32
174	2,982	23	160	402	1,771	23	6,880	1,310	7,308	33
172	2,862	24	159	388	1,780	27	6,761	1,312	6,871	34
165	2,499	24	149	367	1,716	27	6,478	1,327	6,209	35
167	2,501	24	138	358	1,665	28	6,765	1,336	5,906	36
158	2,358	23	128	347	1,600	28	6,577	1,346	5,647	37
164	2,186	21	113	359	1,530	25	6,617	1,327	5,671	38
173	2,158	21	116	365	1,506	21	6,585	1,285	5,735	39
	46			1	1		59	13	222	40
	49			1	1		62	13	244	41
	50			1	1		65	13	254	42
	50			1	1		61	12	262	43
	51			1	1		59	11	262	44
	51			1	1		59	10	261	45
	49			1	1		54	10	224	46
	41			1	1		47	10	193	47
	45			1	1		52	10	183	48
	42			1	1		49	10	169	49
	44			1	1		59	10	158	50
	46			1	1		58	10	184	51
2	6	1	2		3		12	63	2	52
2	6	1	2		3		12	62	2	53
2	6	1	2		3		12	62	2	54
2	6	1	2		3		12	67	2	55
2	6	1	2		3		12	74	2	56
2	6	1	2		3		15	76	2	57
2	7	1	2		3		14	77	2	58
2	7	1	2		3		15	76	2	59
2	9	1	2		3		12	77	2	60
2	9	1	2		3		14	71	2	61
2	8	1	2		3		14	68	2	62
2	8	1	2		3		12	67	2	63
$16,045	$490,140	$5,530	$24,252	$36,146	$191,970	$1,201	$1,313,204	$109,190	$1,481,585	64
$240	$98,867	$1,920	$6,362	$2,270	$29,829		$263,014	$8,420	$112,329	65
$1,189	$23,880	$415	$1,674	$5,514	$16,844	$485	$90,210	$12,192	$75,445	66
$14,616	$360,377	$2,795	$16,216	$27,372	$136,497	$716	$938,079	$86,856	$1,278,679	67
	$7,016	$400		$900	$8,800		$21,901	$1,722	$15,132	68
$96,491	$3,587,478	$37,369	$113,340	$195,851	$1,036,002	$27,364	$5,008,143	$1,229,396	$8,437,352	69
$24,214	$350,931	$6,200	$19,012	$30,795	$182,598	$5,350	$660,881	$145,405	$781,451	70
$51,765	$403,227	$7,800	$26,982	$50,096	$204,312	$6,500	$760,917	$191,385	$782,980	71
$225	$491,504	$1,860	$5,787	$9,798	$63,298	$2,400	$554,902	$97,332	$699,211	72
$4,279	$205,429	$2,150	$13,594	$14,470	$82,656	$1,250	$351,503	$100,914	$501,678	73
$200	$200,450	$650	$4,853	$16,370	$38,672	$700	$354,611	$59,712	$620,814	74
$250	$365.321	$150	$2,388	$12,316	$22,005	$1,075	$315,063	$95,395	$894,141	75
	$123,436	$5,392	$11,270	$4,194	$72,258	$200	$248,923	$30,605	$515,464	76
	37,622	2	13	97	1,678	6	1,991	7,546	147,537	77
	$204,714	$23	$621	$689	$5,888	$57	$21,131	$24,099	$598,116	78
	8,100	15	62	868	454	30	3,108	7,229	50,018	79
	$91,978	$525	$500	$2,288	$6,604	$300	$35,322	$18,918	$116,982	80
60	4,348		375	87	42	60	353	1,733	4,895	81
$300	$38,307		$3,000	$529	$1,405	$400	$6,928	$5,120	$20,688	82
4	416	10	30	12	356	26	2,438	309	7,786	83
$50	$3,285	$150	$292	$165	$3,436	$340	$22,133	$2,338	$38,263	84
250	321,951	692	3,060	11,230	30,789	820	215,495	109,066	719,553	85
$565	$394,660	$2,056	$8,302	$24,668	$104,512	$2,050	$473,592	$193,358	$966,127	86
$1,635	$280,284	$2,200	$6,400	$12,652	$100,183	$3,420	$417,928	$95,396	$767,032	87

TABLE 7.—CARRIAGES AND WAGONS—DETAILED

		Louisiana.	Maine.	Maryland.	Massachusetts.	Michigan.	Minnesota.
	Materials used—Continued.						
88	Fuel	$5,513	$12,006	$10,849	$42,575	$113,319	$27,385
89	Rent of power and heat	$1,551	$1,525	$2,424	$16,914	$4,972	$2,843
90	Mill supplies	$879	$753	$1,496	$3,920	$18,757	$2,606
91	All other materials	$10,009	$21,418	$48,724	$141,688	$1,305,791	$37,122
92	Freight	$1,404	$2,448	$1,983	$14,184	$140,433	$25,555
93	Products, total value	$436,434	$937,644	$1,143,463	$4,179,724	$12,101,170	$1,715,858
	Family and pleasure carriages—						
94	Number	89	2,802	2,945	8,106	174,889	3,662
95	Value	$12,514	$272,244	$291,881	$1,480,339	$7,784,444	$232,282
	Public conveyances—						
96	Number	4		8	142	120	4
97	Value	$600		$2,025	$113,760	$116,026	$615
	Wagons (business, farm, government, municipal, etc.)—						
98	Number	1,246	1,764	1,849	3,278	52,273	15,059
99	Value	$148,484	$154,989	$225,360	$605,678	$2,352,958	$790,290
	Sleighs and sleds—						
100	Number		2,802	62	1,062	53,180	10,003
101	Value		$117,075	$1,909	$79,824	$977,822	$169,830
	Automobiles—						
102	Number				49		3
103	Value				$26,100		$1,400
104	Parts manufactured, not elsewhere included	$4,460	$7,010	$4,090	$8,401	$11,737	$21,470
105	All other products	$1,183	$11,775	$57,579	$132,274	$360,511	$64,013
106	Amount received for repair work	$269,193	$374,551	$560,619	$1,733,348	$497,672	$435,958
	Kind and quantity of products:						
107	Family and pleasure carriages, aggregate number	89	2,802	2,945	8,106	174,889	3,662
108	Two-wheeled, total number	21	5	117	374	6,440	504
109	Cars					300	
110	Carts	3	5	104	342	6,005	503
111	Gigs	18			2		
112	Sulkies			13	25	85	
113	Tandems				4	25	
114	Other				1	25	1
115	Four-wheeled, for one or two persons, total number	56	2,347	2,366	4,830	139,345	2,023
116	Buggies	45	391	1,393	1,263	88,107	1,518
117	Buckboards		125	27		443	2
118	Driving wagons		1,161	95	280	16,414	464
119	Park wagons		190	8	180	158	
120	Phaetons	9	56	97	67	754	
121	Pony wagons		1	3	303	1,353	1
122	Road wagons		235	225	700	18,755	5
123	Runabouts		67	459	934	9,662	26
124	Spiders			1	43		
125	Stanhopes		57	26	655	2,302	4
126	Traps	2		18	29	212	
127	Other		64	14	376	1,185	3
128	Four-wheeled, for three or more persons, total number	12	450	462	2,902	29,104	1,135
129	Brakes		4	24	32	1	
130	Broughams		2	6	212	3	15
131	Buckboards		63	32	10	76	
132	Cabriolets		12	6	196	100	
133	Coupes			3	25	1	
134	Landaus	4			44		
135	Mountain wagons			39	64	773	
136	Park wagons			13	222	460	3
137	Phaetons			10	20	16	
138	Road wagons		212	131	409	3,010	1,013
139	Rockaways		10	19	432		
140	Spiders			15	1		
141	Surreys	6	45	148	440	16,680	104
142	Tallyhos	2					
143	Traps			1	38		
144	Victorias			4	32	2	
145	Vis-a-vis				7		
146	Other		102	11	718	7,982	
147	Public conveyances, total number	4		8	142	120	4
148	Cabs				1		
149	Hacks	4			65	115	
150	Hansoms				55		
151	Hotel coaches			7		2	2
152	Omnibuses			1	16	2	1
153	Other				5	1	1
154	Business wagons, total number	991	886	1,626	2,914	20,283	853
155	Baggage transfer wagons	18	10	105	58	272	47
156	Caravans		3	10	119		
157	Coal wagons and carts	36	35	66	237	114	23
158	Delivery wagons	408	187	617	901	8,661	426
159	Drays		39	10	28	481	119
160	Dump dirt wagons and carts	36	334	249	268	31	7
161	Express wagons	164	194	147	614	177	38
162	Furniture vans			2	5	22	2
163	Furniture wagons	26	6	23	51	35	9
164	Garbage wagons and carts	8		7	12		
165	Handcarts		1	22	10	119	36
166	Hearses				19		
167	Ice wagons	36	4	13	54	30	2
168	Log wagons	244	27	29	35	133	11
169	Ore wagons					27	8
170	Street sprinklers		1				10
171	Street sweepers					3	
172	Trucks	4	12	158	26	1,818	71
173	Other	11	33	168	477	8,360	44
174	Wagons (government, municipal, etc.), total number	4	4	55	47	1,469	9
175	Ambulances				13	2	2
176	Fire patrol wagons			1	11		
177	Hose wagons	3	3	1	20	1	2
178	Mail and mail carriers' wagons and carts		1	47	1	1,466	5
179	Police patrol wagons	1		3	2		
180	Prison vans			3			
181	Farm wagons, total number	251	874	168	317	30,521	14,197
182	One-horse	25	174	50	148	3,525	791
183	Two-horse	98	671	60	117	26,410	9,883
184	Mountain				2	150	3,008
185	Dump carts or farm trucks	128	29	58	50	436	515

SUMMARY, BY STATES AND TERRITORIES: 1905—Continued.

Mississippi.	Missouri.	Montana	Nebraska.	New Hampshire.	New Jersey.	New Mexico.	New York.	North Carolina.	Ohio.	
$3,423	$43,314	$1,780	$2,734	$7,865	$35,396	$947	$131,428	$19,344	$96,297	88
$225	$11,510	$690	$1,475	$1,550	$5,617	$675	$15,732	$1,145	$21,367	89
$1,240	$6,401	$195	$186	$1,165	$5,037	$200	$26,098	$3,522	$29,261	90
$6,525	$337,126	$4,700	$2,181	$4,675	$93,108	$1,500	$534,245	$102,892	$899,034	91
$1,595	$35,601	$848	$3,763	$1,566	$9,017		$76,806	$42,516	$88,446	92
$239,566	$6,551,130	$107,060	$285,984	$565,944	$2,813,534	$65,850	$12,573,148	$2,304,065	$16,096,125	93
	74,650	17	103	1,943	3,341	38	42,249	25,157	199,428	94
	$3,826,342	$2,350	$18,637	$163,657	$492,810	$3,500	$4,550,893	$1,302,259	$11,373,346	95
	58		6		127	21	742	67	217	96
	$4,445		$1,900		$25,365	$2,350	$518,469	$7,330	$107,141	97
2,012	25,281	37	916	1,188	5,647	146	19,879	23,553	40,905	98
$171,535	$1,507,225	$9,710	$72,644	$219,923	$779,351	$12,480	$2,448,670	$773,302	$2,703,566	99
	6		3	694	228		19,433	5	8,479	100
	$153		$60	$33,141	$10,466		$592,768	$45	$52,166	101
	6			1			10		16	102
	$3,984			$1,100			$43,775		$16,000	103
$1,266	$37,550		$545	$340	$13,911	$1,000	$59,905	$8,513	$168,205	104
$31,180	$57,712	$5,500	$36,418	$2,558	$195,705	$5,000	$514,869	$19,394	$217,224	105
$35,585	$1,113,719	$89,500	$155,780	$145,225	$1,295,926	$41,520	$3,843,799	$193,222	$1,458,477	106
	74,650	17	103	1,943	3,341	38	42,249	25,157	199,428	107
	73	5	4		502		3,445	50	4,396	108
					4		1	1	75	109
	65	5	4		379		3,154	49	3,917	110
					6		39			111
	8				111		238		404	112
					2		7			113
							6			114
	63,523	10	69	1,030	1,936	38	33,236	24,485	169,031	115
	54,164	9	29	509	1.357	16	18,542	23,769	129,005	116
	25		10	10	12	10	1,476	6	1,301	117
	2,345		10	316	38	10	809	25	3,780	118
	89				47	2	106	5	593	119
	794		1		74		339	79	5,868	120
					16		27	25	2,330	121
	1,004		2	33	50		5,537	39	4,627	122
	4,264	1	11	65	276		5,273	506	18,863	123
	25		1		5		28		185	124
	335		4	51	15		1,057	25	1,976	125
	19		1		33		22	1	493	126
	459			46	13		20	5	10	127
	11,054	2	30	913	903		5,568	622	26,001	128
	19						12	5	18	129
	24				15		196		59	130
				3	11		591		853	131
	28		1		15		301		277	132
	4			1	4		63		10	133
	1				9		70		75	134
	42	2			4		123	4	228	135
	31		5	9	6		132		689	136
	19		4		6		123	50	425	137
	9			27	10		601	7	469	138
	31		2		69		229	2	383	139
					5		18			140
	8,957		8	100	562		2,577	501	19,352	141
							6			142
					1		109	2	457	143
	2		1		4		104	51	47	144
	17						18		8	145
	1,870		9	773	182		295		2,651	146
	58		6		127	21	742	67	217	147
						10	11		5	148
	55		2		79	10	474	67	164	149
							5			150
			2		4	1	59		40	151
			2		27		131		4	152
	3				17		62		4	153
1,320	2,677	37	739	965	4,529	103	12,797	1,082	7,988	154
7	92		29	12	26	2	147	14	200	155
	5			181						156
	80	3	15	16	282	5	373	16	283	157
29	1,278	29	287	260	2,128	36	3,907	337	3,655	158
91	64		7	2	69		120	72	116	159
6	211		350	12	417	44	2,223	287	206	160
	68			344	718	5	561		806	161
	6	1		1	26		81		40	162
	71		4	28	28		55	15	134	163
	2				4		118		17	164
	12				54		2,330	53	37	165
	57		1		7		238		255	166
12	80		2	6	56	4	75	13	75	167
839	162			13	17		18	219	19	168
					1					169
	21			15		2	1		4	170
					2					171
	259	1	28	25	525	5	1,370	34	349	172
336	209	3	16	50	169		1,180	22	1,792	173
	119		2	11	31	3	83	8	272	174
	7			8	5		63		45	175
					2		1		1	176
	20		1	3	6		15	1	98	177
	85				10	3	3	7	127	178
	7		1		8		1		1	179
										180
692	22,485		175	212	1,087	40	6,999	22,463	32,645	181
27	452			95	411		1,230	10,683	2,621	182
665	21,926			88	538	35	5,647	11,075	28,047	183
	1		175						1,426	184
	106			29	138	5	122	705	551	185

TABLE 7.—CARRIAGES AND WAGONS—DETAILED

		Louisiana.	Maine.	Maryland.	Massachusetts.	Michigan.	Minnesota.
	Kind and quantity of products—Continued.						
186	Sleighs, total number	.....	2,802	62	1,062	53,180	10,003
187	One-seated	.....	1,112	27	113	41,943	651
188	Two-seated	.....	360	21	49	1,972	149
189	Speeding or racing	.....	211	10	31	593	.....
190	Sleds, horse, including "bobs"	.....	1,119	4	869	8,672	9,203
191	Automobiles, total number	.....	.....	.....	49	.....	3
192	Runabout	.....	.....	.....	22	.....	2
193	Touring	.....	.....	.....	25	.....	.....
194	Surrey	.....	.....	.....	.....	.....	.....
195	Phaeton	.....	.....	.....	.....	.....	.....
196	Doctor's wagon or car	.....	.....	.....	.....	.....	1
197	Delivery, light	.....	.....	.....	2	.....	.....
198	Delivery, heavy	.....	.....	.....	.....	.....	.....
199	Other	.....	.....	.....	.....	.....	.....
	Parts manufactured, not elsewhere included—						
200	Carriage bodies	.....	46	2	78	617	405
201	Wagon bodies	93	70	52	132	1,789	248
202	Tops	54	2	33	66	7,707	16
203	Wheels	360	3,250	494	37	94,366	413
	Power:						
204	Number of establishments reporting	16	57	26	112	101	73
205	Total horsepower	220	702	564	1,770	5,796	1,712
	Owned—						
	Engines—						
	Steam—						
206	Number	8	19	14	33	63	29
207	Horsepower	126	256	274	758	4,661	1,214
	Gas and gasoline—						
208	Number	3	30	6	28	34	39
209	Horsepower	29	199	48	212	417	299
	Water wheels—						
210	Number	.....	6	5	2	2	.....
211	Horsepower	.....	157	132	20	123	.....
	Water motors—						
212	Number	.....	.....	.....	.....	.....	.....
213	Horsepower	.....	.....	.....	.....	.....	.....
	Electric motors—						
214	Number	.....	.....	.....	2	30	17
215	Horsepower	.....	.....	.....	12	299	60
216	Other power, horsepower	.....	.....	22	.....	.....	.....
	Rented—						
	Electric motors—						
217	Number	5	10	10	58	42	19
218	Horsepower	65	90	86	477	271	138
219	Other kind, horsepower	.....	.....	2	291	25	1
220	Furnished to other establishments, horsepower	.....	.....	.....	.....	.....	50

SUMMARY, BY STATES AND TERRITORIES: 1905—Continued.

Mississippi.	Missouri.	Montana.	Nebraska.	New Hampshire.	New Jersey.	New Mexico.	New York.	North Carolina.	Ohio.	
	5		2	604	228		19,433	5	8,479	186
	1		2	351	148		13,780	5	524	187
				33	29		1,806		3	188
					3		291			189
	5			310	48		3,556		7,952	190
	6			1			10		16	191
							1		3	192
	2									193
				1					12	194
									1	195
										196
	2									197
	2						2			198
							7			199
	376		9	12	44	15	667	566	4,661	200
27	1,184		22		289	25	545	318	115	201
	1,707		10		49		306	45	202	202
	1,892		21		182		1,136	1,358	182,438	203
8	103	5	10	29	68	2	239	50	162	204
413	1,970	21	94	507	1,091	24	6,310	1,310	7,375	205
9	33			11	22		98	38	71	206
394	1,207			233	597		3,971	1,165	4,614	207
1	27	1	6	10	33		74	11	49	208
4	205	5	38	64	280		790	65	730	209
				10	2		23	1		210
				121	20		768	10		211
				2			8			212
				8			44			213
				1			4		34	214
				10			85		385	215
										216
1	107	6	10	5	26	2	100	3	154	217
15	458	15	56	71	188	24	617	55	1,605	218
	100				6		35	15	41	219
	1			7	20		22	30		220

TABLE 7.—CARRIAGES AND WAGONS—DETAILED

		Oklahoma.	Oregon.	Pennsylvania.	Rhode Island.	South Carolina.
1	Number of establishments	8	14	601	30	38
2	Capital, total	$53,990	$93,595	$8,830,520	$328,684	$502,243
3	Land	$7,025	$3,300	$1,275,394	$62,000	$38,410
4	Buildings	$15,750	$11,489	$2,078,435	$66,100	$53,234
5	Machinery, tools, and implements	$6,300	$22,308	$1,071,523	$52,828	$54,396
6	Cash and sundries	$24,915	$56,498	$4,405,168	$147,756	$356,203
7	Proprietors and firm members	8	15	758	33	42
	Salaried officials, clerks, etc.:					
8	Total number	1	4	310	8	16
9	Total salaries	$520	$1,033	$277,310	$6,756	$20,480
	Officers of corporations—					
10	Number			48	1	4
11	Salaries			$73,188	$1,200	$6,300
	General superintendents, managers, clerks, etc.—					
12	Total number	1	4	262	7	12
13	Total salaries	$520	$1,033	$204,122	$5,556	$14,180
	Men—					
14	Number	1	3	235	6	9
15	Salaries	$520	$818	$190,946	$5,156	$13,040
	Women—					
16	Number		1	27	1	3
17	Salaries		$215	$13,176	$400	$1,140
	Wage-earners, including pieceworkers, and total wages:					
18	Greatest number employed at any one time during the year	61	81	6,643	289	422
19	Least number employed at any one time during the year	37	40	4,687	183	301
20	Average number	43	52	5,569	228	346
21	Total wages	$23,407	$36,209	$2,794,365	$140,218	$118,280
	Men 16 years and over—					
22	Average number	43	52	5,488	225	329
23	Wages	$23,407	$36,209	$2,778,910	$139,263	$115,010
	Women 16 years and over—					
24	Average number			25	3	6
25	Wages			$5,973	$955	$1,936
	Children under 16 years—					
26	Average number			56		11
27	Wages			$9,482		$1,334
	Average number of wage-earners, including pieceworkers, employed during each month:					
	Men 16 years and over—					
28	January	38	41	5,196	195	304
29	February	42	38	5,323	203	304
30	March	41	38	5,589	213	303
31	April	45	65	5,702	247	308
32	May	49	57	5,927	260	309
33	June	50	65	5,962	269	326
34	July	48	58	5,901	254	332
35	August	44	54	5,536	239	348
36	September	44	52	5,392	224	365
37	October	40	52	5,175	205	363
38	November	38	56	5,098	198	352
39	December	37	48	5,055	193	334
	Women 16 years and over—					
40	January			24	3	6
41	February			26	3	6
42	March			26	3	6
43	April			26	3	6
44	May			25	3	6
45	June			26	3	6
46	July			26	3	6
47	August			26	3	6
48	September			24	3	6
49	October			25	3	6
50	November			24	3	6
51	December			22	3	6
	Children under 16 years—					
52	January			55		10
53	February			55		10
54	March			55		10
55	April			57		10
56	May			62		10
57	June			63		14
58	July			58		11
59	August			69		11
60	September			51		12
61	October			49		12
62	November			48		10
63	December			50		12
64	Miscellaneous expenses, total	$3,149	$5,940	$603,455	$19,086	$28,441
65	Rent of works	$800	$4,046	$84,468	$6,916	$1,932
66	Taxes	$416	$365	$36,999	$1,641	$2,556
67	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$1,933	$1,529	$471,483	$9,829	$23,953
68	Contract work			$10,505	$700	
69	Materials used, total cost	$26,008	$45,761	$3,557,514	$116,627	$289,740
70	Lumber	$2,735	$9,747	$550,539	$18,955	$23,995
71	Iron and steel	$4,875	$14,423	$617,894	$38,878	$33,922
72	Carriage hardware, lamps, and mountings	$2,810	$3,245	$404,306	$8,007	$20,334
73	Paints, oils, turpentine, and varnish	$2,220	$2,275	$317,882	$10,308	$14,502
74	Enamel, rubber, and other carriage cloth	$2,074	$350	$223,506	$2,016	$14,252
75	Leather	$1,135	$775	$116,380	$811	$29,562
76	Rubber tires	$1,495	$1,297	$154,085	$4,440	$3,757
	Carriage bodies, purchased—					
77	Number	64	5	6,171	2	662
78	Cost	$376	$28	$50,541	$30	$2,155
	Gears, purchased—					
79	Number	67	6	2,369	246	558
80	Cost	$427	$150	$37,511	$1,798	$1,228
	Wagon bodies, purchased—					
81	Number			1,448	28	28
82	Cost			$24,279	$355	$134
	Tops, purchased—					
83	Number	75	21	717	14	221
84	Cost	$486	$554	$5,699	$265	$1,825
	Wheels, purchased—					
85	Number	816	796	143,926	2,996	34,362
86	Cost	$1,777	$3,019	$353,030	$9,268	$42,013
87	Axles and springs, purchased	$1,364	$2,438	$304,312	$6,716	$23,105

[1] Includes establishments distributed as follows: Arizona, 1; Indian Territory, 1; Nevada, 1; North Dakota, 1; Wyoming, 1.

SUMMARY, BY STATES AND TERRITORIES: 1905—Continued.

South Dakota.	Tennessee.	Texas.	Utah.	Vermont.	Virginia.	Washington.	West Virginia.	Wisconsin.	All other states.[1]	
3	59	54	3	32	72	25	34	311	5	1
$54,415	$1,445,350	$285,514	$2,950	$214,301	$1,615,715	$230,418	$313,614	$9,751,420	$28,030	2
$9,500	$138,182	$53,348	$200	$23,420	$130,560	$52,800	$50,175	$849,643	$1,350	3
$23,000	$195,179	$68,403	$750	$68,200	$244,630	$37,650	$53,004	$1,780,170	$4,000	4
$3,000	$212,784	$51,719	$900	$29,005	$115,625	$53,000	$39,766	$960,928	$11,650	5
$18,915	$899,205	$112,044	$1,100	$93,676	$1,124,900	$86,968	$170,669	$6,160,679	$11,030	6
2	73	41	4	46	111	36	43	387	6	7
2	83	9	....	1	70	12	18	246	1	8
$2,000	$94,346	$8,536	....	$1,000	$61,226	$10,768	$16,375	$276,385	$1,800	9
2	21	3	....	....	16	1	2	36	1	10
$2,000	$43,606	$5,400	....	....	$21,100	$1,500	$3,300	$66,138	$1,800	11
....	62	6	....	1	54	11	16	210	....	12
....	$50,740	$3,136	....	$1,000	$40,126	$9,268	$13,075	$210,247	....	13
....	48	6	....	1	46	9	13	175	....	14
....	$43,938	$3,136	....	$1,000	$37,346	$8,548	$11,400	$193,163	....	15
....	14	....	....	....	8	2	3	35	....	16
....	$6,802	....	....	....	$2,780	$720	$1,675	$17,084	....	17
20	1,083	251	11	130	1,203	257	249	3,955	32	18
18	790	180	6	94	940	164	190	3,014	28	19
19	917	211	8	108	1,046	201	221	3,506	25	20
$12,528	$416,682	$124,082	$5,675	$58,825	$372,490	$158,200	$113,032	$1,724,017	$14,295	21
19	904	211	8	108	997	200	219	3,451	25	22
$12,528	$414,080	$124,082	$5,675	$58,825	$363,388	$157,960	$112,715	$1,709,135	$14,295	23
....	5	....	....	....	2	1	1	34	....	24
....	$1,265	....	....	....	$750	$240	$135	$11,278	....	25
....	8	....	....	....	47	....	1	21	....	26
....	$1,337	....	....	....	$8,352	....	$182	$3,604	....	27
18	875	181	7	101	916	173	214	3,363	17	28
18	877	185	7	106	941	175	224	3,405	17	29
18	928	195	6	115	989	181	228	3,543	18	30
18	899	209	7	116	999	194	229	3,513	30	31
20	898	227	8	116	1,016	215	224	3,501	30	32
20	900	229	9	120	1,009	214	211	3,489	31	33
20	899	232	10	112	1,018	236	208	3,490	31	34
20	903	232	10	103	1,018	232	214	3,411	31	35
20	914	229	9	104	1,046	219	219	3,398	31	36
20	944	215	9	103	1,051	199	220	3,417	30	37
18	907	205	7	102	1,001	186	220	3,431	17	38
18	904	193	7	98	960	176	217	3,451	17	39
....	4	....	....	....	2	1	3	35	....	40
....	5	....	....	....	2	1	3	36	....	41
....	5	....	....	....	2	1	3	36	....	42
....	6	....	....	....	2	1	3	36	....	43
....	5	....	....	....	2	1	....	36	....	44
....	5	....	....	....	2	1	....	35	....	45
....	5	....	....	....	2	1	....	32	....	46
....	5	....	....	....	2	1	....	29	....	47
....	5	....	....	....	2	1	....	31	....	48
....	5	....	....	....	2	1	....	32	....	49
....	5	....	....	....	2	1	....	34	....	50
....	5	....	....	....	2	1	....	36	....	51
....	6	....	....	....	39	....	1	20	....	52
....	6	....	....	....	39	....	1	20	....	53
....	8	....	....	....	45	....	1	20	....	54
....	8	....	....	....	48	....	1	24	....	55
....	8	....	....	....	49	....	1	22	....	56
....	10	....	....	....	55	....	1	22	....	57
....	8	....	....	....	57	....	1	22	....	58
....	9	....	....	....	55	....	1	21	....	59
....	9	....	....	....	51	....	1	20	....	60
....	8	....	....	....	46	....	1	20	....	61
....	8	....	....	....	41	....	1	20	....	62
....	8	....	....	....	39	....	1	21	....	63
$2,010	$122,837	$21,224	$702	$8,353	$81,938	$21,503	$20,826	$644,000	$4,225	64
....	$23,204	$6,840	$222	$632	$8,583	$9,203	$1,775	$12,177	$1,545	65
$640	$8,599	$2,393	$18	$1,716	$8,568	$2,253	$1,521	$48,939	$358	66
$1,370	$90,909	$10,091	$212	$5,805	$64,384	$8,997	$17,530	$571,290	$2,322	67
....	$125	$1,900	$250	$200	$403	$1,050	....	$11,594	....	68
$9,903	$898,447	$130,164	$4,315	$54,816	$1,029,976	$188,314	$210,452	$3,725,358	$17,353	69
$2,800	$227,509	$17,541	$750	$8,041	$175,038	$33,460	$42,456	$1,270,721	$3,600	70
$3,000	$206,320	$32,027	$1,850	$12,798	$176,213	$62,299	$43,567	$938,794	$4,156	71
$800	$53,098	$13,183	$393	$5,604	$123,701	$7,140	$7,880	$178,337	$345	72
$850	$55,939	$8,501	$50	$6,500	$79,905	$10,396	$16,243	$227,012	$1,746	73
$440	$19,167	$4,720	$90	$1,924	$61,905	$4,124	$5,624	$96,160	$1,144	74
$60	$26,959	$3,805	$10	$1,600	$85,606	$2,145	$4,302	$134,745	$1,045	75
$300	$33,649	$16,945	$25	$690	$22,747	$5,094	$7,521	$56,548	$150	76
....	2,008	10	....	6	9,958	160	365	3,006	2	77
....	$9,295	$75	....	$48	$21,581	$1,250	$2,325	$20,370	$9	78
....	244	168	110	15	2,953	44	139	1,316	34	79
....	$2,154	$1,555	$575	$382	$12,422	$300	$1,441	$15,064	$1,992	80
5	3	20	....	....	74	....	200	139	....	81
$58	$100	$377	....	....	$262	....	$2,000	$1,543	....	82
13	233	86	10	36	171	84	588	1,471	5	83
$200	$1,745	$953	$65	$340	$1,450	$957	$5,743	$18,328	$35	84
120	50,539	3,026	40	1,604	68,404	5,790	12,724	91,115	222	85
$300	$101,032	$7,177	$120	$5,668	$101,626	$21,605	$21,720	$186,413	$560	86
$185	$51,294	$7,276	$210	$4,137	$65,537	$19,478	$22,948	$170,430	$310	87

TABLE 7.—CARRIAGES AND WAGONS—DETAILED

		Oklahoma.	Oregon.	Pennsylvania.	Rhode Island.	South Carolina.
	Materials used—Continued.					
88	Fuel	$961	$2,916	$85,230	$4,426	$4,493
89	Rent of power and heat	$528	$1,104	$9,592	$2,138	$350
90	Mill supplies	$154	$190	$11,130	$405	$1,069
91	All other materials	$633	$3,093	$250,488	$6,413	$72,538
92	Freight	$1,958	$157	$41,110	$1,398	$506
93	Products, total value	$66,921	$114,429	$8,620,787	$369,870	$548,226
	Family and pleasure carriages—					
94	Number	65	56	33,467	40	7,440
95	Value	$6,430	$3,480	$2,355,043	$4,660	$353,569
	Public conveyances—					
96	Number	1	31	333	1	2
97	Value	$120	$2,775	$117,093	$177	[illegible]
	Wagons (business, government, municipal, etc.)—					
98	Number	68	142	35,395	481	1,569
99	Value	$8,236	$35,655	$2,839,372	$59,682	$55,707
	Sleighs and sleds—					
100	Number		16	5,551	163	
101	Value		$320	$150,461	$5,695	
	Automobiles—					
102	Number			18		
103	Value			$21,100		
104	Parts manufactured, not elsewhere included	$200	[illegible]	$50,819	$2,768	$2,967
105	All other products	$1,000	$5,100	$120,929	$2,869	$4,557
106	Amount received for repair work	$50,935	$66,191	$2,965,970	$294,019	$131,126
	Kind and quantity of products:					
107	Family and pleasure carriages, aggregate number	65	56	33,467	40	7,440
108	Two-wheeled, total number	2		733	20	11
109	Cars					
110	Carts	2		656	20	11
111	Gigs					
112	Sulkies			37		
113	Tandems					
114	Other			40		
115	Four-wheeled, for one or two persons, total number	56	55	27,919	18	7,422
116	Buggies	50	53	18,525	3	7,420
117	Buckboards	2	2	1,368		2
118	Driving wagons			527	1	
119	Park wagons			26		
120	Phaetons			421		
121	Pony wagons			100		
122	Road wagons			1,770	8	
123	Runabouts			3,499	5	
124	Spiders	1		1		
125	Stanhopes	3		316		
126	Traps			166		
127	Other			1,200	1	
128	Four-wheeled, for three or more persons, total number	7	1	4,815	2	7
129	Brakes			18		
130	Broughams			135		
131	Buckboards		1	50		
132	Cabriolets			60		
133	Coupes			1		
134	Landaus			1		
135	Mountain wagons			15		
136	Park wagons	1		27		
137	Phaetons			22		
138	Road wagons			721		
139	Rockaways			830		
140	Spiders			1		
141	Surreys	5		2,050	1	7
142	Tallyhos			3		
143	Traps			288		
144	Victorias			4		
145	Vis-a-vis			2		
146	Other	1		587	1	
147	Public conveyances, total number	1	31	333	1	2
148	Cabs			114		
149	Hacks	1	28	115		
150	Hansoms					
151	Hotel coaches		3	84		2
152	Omnibuses			14		
153	Other			6	1	
154	Business wagons, total number	63	129	21,722	396	108
155	Baggage transfer wagons	1		233		
156	Caravans			18		
157	Coal wagons and carts	1		488	45	
158	Delivery wagons	41	121	11,244	125	36
159	Drays	5		271	4	4
160	Dump dirt wagons and carts			633	36	19
161	Express wagons	4	2	1,227	136	
162	Furniture vans	1		38		
163	Furniture wagons			127	1	1
164	Garbage wagons and carts			23	11	1
165	Handcarts	3	1	378	10	[illegible]
166	Hearses			40		
167	Ice wagons	1		164	2	
168	Log wagons			94	2	8
169	Ore wagons			8		
170	Street sprinklers		1	3		
171	Street sweepers					
172	Trucks	2	3	4,945	19	3
173	Other	[illegible]	1	1,788	5	30
174	Wagons (government, municipal, etc.), total number	2	3	352	5	
175	Ambulances			58	1	
176	Fire patrol wagons			12		
177	Hose wagons	1	3	16	4	
178	Mail and mail carriers' wagons and carts	1		264		
179	Police patrol wagons			[illegible]		
180	Prison vans					
181	Farm wagons, total number	3	10	13,321	80	1,461
182	One-horse		5	2,078	16	1,142
183	Two-horse	3	1	6,204	27	247
184	Mountain		3	277		
185	Dump carts or farm trucks		1	4,762	37	72

SUMMARY, BY STATES AND TERRITORIES: 1905—Continued.

South Dakota.	Tennessee.	Texas.	Utah.	Vermont.	Virginia.	Washington.	West Virginia.	Wisconsin.	All other states.	
$730	$14,982	$3,844	$175	$3,296	$10,702	$6,454	$4,721	$77,155	$871	88
$100	$1,892	$2,498		$720	$1,270	$3,805	$181	$3,027	$722	89
$80	$5,153	$414	$2	$320	$2,627	$498	$1,187	$13,672	$138	90
	$52,903	$8,099		$1,943	$60,663	$4,785	$9,536	$222,571	$290	91
	$35,256	$1,174		$805	$26,721	$4,524	$11,057	$94,468	$240	92
$31,119	$1,774,725	$367,547	$12,300	$163,756	$1,913,530	$482,263	$443,291	$7,511,392	$43,745	93
15	5,374	100	2	169	19,366	125	1,180	23,466	26	94
$1,555	$356,469	$11,425	$70	$14,180	$970,502	$13,575	$80,550	$1,520,841	$2,660	95
1	168		1		28		3	103		96
$150	$27,212		$130		$3,690		$200	$39,720		97
47	20,241	718	26	652	19,195	804	5,117	83,916	170	98
$5,830	$960,913	$76,349	$3,565	$49,750	$652,567	$159,505	$231,784	$4,396,693	$20,305	99
9			2	278	6	501	10	15,365	1	100
$184			$50	$11,771	$90	$4,225	$182	$343,509	$42	101
					1					102
					$1,800					103
	$2,910	$1,240		$100	$5,564	$1,000	$125	$5,382	$160	104
$1,500	$60,722	$16,644	$700	$3,800	$15,404	$14,540	$2,100	$353,191	$5,152	105
$21,900	$366,499	$261,889	$7,785	$84,155	$263,913	$289,418	$128,350	$852,056	$15,426	106
15	5,374	100	2	169	19,366	125	1,180	23,466	26	107
	16	6	2	2	32	31	2	23		108
								2		109
	16	6		2	32	29	2	17		110
						2				111
								2		112
										113
			2					2		114
14	5,032	89		149	18,293	71	948	17,175	21	115
12	4,045	45		95	16,588	52	254	11,728	3	116
	16	2		13	165	8	558	156		117
	14			12	18	3	36	1,775	12	118
					11			337	1	119
	85	6			307	1	11	127		120
	1				7	1		47	4	121
2	200	25		19	860	2	28	2,292	1	122
	388	9			246	2	55	348		123
										124
	17	2			34	1	6	359		125
					54	1		4		126
	66			10	3			2		127
1	326	5		18	1,041	23	230	6,268	5	128
								1		129
	1							6		130
	1	4		10			181	13	2	131
					3			37		132
										133
							1	5		134
		1			10	2	13	366	1	135
	10				3			308		136
	25				4			8		137
	8			5	200	2		1,729		138
	1				11		3	2		139
										140
1	261			3	807	18	31	2,455		141
									2	142
	9				1	1		94		143
	1									144
										145
	9				2		1	1,244		146
1	168		1		28		3	103		147
										148
1	151				27		3	18		149
										150
	10				1			53		151
								2		152
	7		1					30		153
26	2,749	550	26	114	1,504	780	508	12,910	60	154
	36	9	5	4	130	17	32	108	8	155
					4	6	1	11		156
	26	20	5	4	31		10	206		157
15	1,372	358	4	53	411	440	209	5,022	17	158
10	67	12			83	12	117	93	2	159
	63	19	2	12	81	12	15	120		160
	72	7		18	56	59	93	418		161
	24	10				22	2	45	1	162
	23	9			24	13	3	62	1	163
						2	7	2		164
	2	5			30	22	1	2,054		165
	2		2		3	2		5		166
	132	8			14	5	5	72	2	167
	428	40		6	300	2		47		168
										169
								11		170
								38		171
	52	3		10	237	152	2	1,321	8	172
1	450	50	8	7	100	14	11	3,275	32	173
	22	3		1	3	5	2	192	1	174
		1			1			2	1	175
								10		176
		1		1	1		2	22		177
	22					5		151		178
		1			1			7		179
										180
21	17,470	165		537	17,688	19	4,607	70,814	109	181
	5,228	3		55	11,604	2	1,837	3,798		182
21	11,971	156		411	5,524	17	2,498	61,322	107	183
	135						60	2,292	2	184
	136	6		71	560		212	3,402		185

TABLE 7.—CARRIAGES AND WAGONS—DETAILED

		Oklahoma.	Oregon.	Pennsylvania.	Rhode Island.	South Carolina.
	Kind and quantity of products—Continued.					
186	Sleighs, total number	.....	16	5,551	163	.....
187	One-seated	.....	1	3,784	4	.....
188	Two-seated	.....	.....	485	.....	.....
189	Speeding or racing	.....	.....	219	.....	.....
190	Sleds, horse, including "bobs"	.....	15	1,063	159	.....
191	Automobiles	.....	.....	18	.....	.....
192	Runabout	.....	.....	2	.....	.....
193	Touring	.....	.....	14	.....	.....
194	Surrey	.....	.....	.....	.....	.....
195	Phaeton	.....	.....	.....	.....	.....
196	Doctor's wagon or car	.....	.....	.....	.....	.....
197	Delivery, light	.....	.....	.....	.....	.....
198	Delivery, heavy	.....	.....	2	.....	.....
199	Other	.....	.....	.....	.....	.....
	Parts manufactured, not elsewhere included—					
200	Carriage bodies	6	36	370	.....	10
201	Wagon bodies	14	40	619	70	119
202	Tops	13		784	4	12
203	Wheels	.....	.....	1,293	.....	662
	Power:					
204	Number of establishments reporting	5	8	247	14	10
205	Total horsepower	15	95	4,908	158	420
	Owned—					
	Engines—					
	Steam—					
206	Number	.....	1	106	4	6
207	Horsepower	.....	60	3,079	60	208
	Gas and gasoline—					
208	Number	5	1	108	4	2
209	Horsepower	5	8	1,242	47	13
	Water wheels—					
210	Number	.....	.....	8	.....	1
211	Horsepower	.....	.....	143	.....	9
	Water motors—					
212	Number	.....	1	2	.....	.....
213	Horsepower	.....	2	4	.....	.....
	Electric motors—					
214	Number	.....	.....	3	.....	33
215	Horsepower	.....	.....	38	.....	100
216	Other power, horsepower	.....	.....	.....	.....	.....
	Rented—					
	Electric motors—					
217	Number	5	5	53	10	2
218	Horsepower	10	25	325	51	90
219	Other kind, horsepower	.....	.....	77	.....	.....
220	Furnished to other establishments, horsepower	.....	.....	18	10	.....

SUMMARY, BY STATES AND TERRITORIES: 1905—Continued.

South Dakota.	Tennessee.	Texas.	Utah.	Vermont.	Virginia.	Washington.	West Virginia.	Wisconsin.	All other states.	
9			2	278	6	501	10	15,365	1	186
1			2	37	2		3	3,084		187
				10	4		7	1,840	1	188
								38		189
8				231		501		10,403		190
					1					191
										192
										193
										194
										195
										196
					1					197
										198
										199
	63	12			31			39		200
	37	30		5	78		[illegible]	183	15	201
		20			151	50	[illegible]	34		202
	400	10			766	100		116	10	203
2	26	12		23	35	20	14	149	3	204
16	1,107	118		324	778	130	365	5,736	50	205
	14	1		3	18		7	73	1	206
	918	35		33	491		237	3,869	15	207
1	9	2		9	10		7	77	1	208
8	108	30		68	102		108	601	10	209
				8	3			2		210
				195	117			55		211
					1					212
					1					213
	1				1			70		214
	25				3			1,014		215
								25		216
1	9	10		3	9	24	1	22	2	217
8	51	53		28	64	130	20	168	25	218
	5							4		219
								10		220

SHIPBUILDING

SHIPBUILDING.

The statistics for shipbuilding at the census of 1905 cover the calendar year 1904. Frequently comparisons are made with the Twelfth and prior censuses in the form of "1905," "1900," etc.

In the general tables of this report the value of products is confined to the value of the work done during the census year. In order to show the numerical output and value of ships launched during the census year, detailed tables are added which give the number of each class of vessels launched during the year with their tonnage and contract value.

In cases where engine construction and shipbuilding work were combined in the same plant, and shipbuilding operations were secondary to the foundry and machine shop or other products reported, the statistics relating to capital invested, labor, cost of materials, etc., were not included in the general tables for the shipbuilding industry, although the vessels launched by such establishments appear in connection with certain detailed tables of this report. On the other hand, whenever the value of the shipbuilding operations predominated, statistics for such establishments appear in the following tables, products other than shipbuilding being classified as "all other products." Statistics of the production of marine engines, marine boilers, anchors, chains, masts, and other shipbuilding supplies by establishments not engaged in shipbuilding are not included in this report.

THE COMBINED INDUSTRY.

Table 1 is a comparative summary, giving the general statistics of the combined industry—iron and steel shipbuilding, and wooden shipbuilding—exclusive of governmental establishments, from 1850 to 1905, with the per cent of increase for each census period.

TABLE 1.—COMPARATIVE SUMMARY, WITH PER CENT OF INCREASE: 1850 TO 1905.

	CENSUS.							PER CENT OF INCREASE.					
	1905[1]	1900	1890	1880	1870	1860	1850	1900 to 1905	1890 to 1900	1880 to 1890	1870 to 1880	1860 to 1870	1850 to 1860
Number of establishments	1,097	1,107	1,006	2,188	964	675	953	[2] 0.9	10.0	[2] 54.0	- 127.0	42.8	[2] 29.2
Capital	$121,623,700	$77,341,001	$27,262,892	$20,979,874	$11,463,076	$5,952,665	$5,373,139	57.3	183.7	29.9	83.0	92.6	10.8
Salaried officials, clerks, etc., number	2,480	1,405	[3] 1,123	(4)	(4)	(4)	(4)	76.5	25.1	....	....	....	....
Salaries	$3,339,741	$2,007,237	[3] $1,194,870	(4)	(4)	(4)	(4)	66.4	68.0	....	....	....	....
Wage-earners, average number	50,754	46,747	22,143	21,345	13,915	10,071	12,976	8.6	111.1	3.7	53.4	38.2	[2] 22.4
Total wages	$29,241,087	$24,824,738	$13,083,949	$12,713,813	$7,073,400	$4,539,313	$6,055,884	17.8	89.8	2.9	79.7	55.8	[2] 25.0
Men 16 years and over	49,915	45,711	21,960	21,338	13,814	10,070	12,962	9.2	108.1	2.9	54.5	37.2	[2] 22.3
Wages	$29,067,884	$24,622,353	$13,055,083	(4)	(4)	(4)	(4)	18.1	88.6	....	....	....	....
Women 16 years and over	65	34	9	....	6	1	14	91.2	277.8	....	[2] 100.0	500.0	[2] 92.9
Wages	$28,454	$11,424	$2,522	....	(4)	(4)	(4)	149.1	353.0	....	....	....	....
Children under 16 years	774	1,002	174	7	95	(4)	(4)	[2] 22.8	475.9	2,385.7	[2] 92.6	....	....
Wages	$144,749	$190,961	$26,344	(4)	(4)	(4)	(4)	[2] 24.2	624.9	....	....	....	....
Miscellaneous expenses	$5,255,506	$3,684,811	$1,392,551	(5)	(5)	(5)	(5)	42.6	164.6	....	....	....	....
Cost of materials used	$37,463,179	$33,474,896	$16,521,246	$19,736,358	$9,379,980	$5,788,676	$7,420,496	11.9	102.6	[2] 16.3	110.4	62.0	[2] 22.0
Value of products, including repair work	$82,769,239	$74,532,277	$38,065,410	$36,800,327	$21,483,967	$13,424,037	$16,937,525	11.1	95.8	3.4	71.3	60.0	[2] 20.7

[1] Exclusive of the statistics of 20 establishments engaged primarily in the manufacture of other products. These establishments reported shipbuilding products to the value of $657,342.
[2] Decrease.
[3] Includes proprietors and firm members with their salaries; number only reported in 1900 and 1905, but not included in this table.
[4] Not reported separately.
[5] Not reported.

For the shipbuilding industry the period covered by the table is particularly interesting, marking as it does the half century of progress during which the transition from wood to iron and steel in the construction of ships radically altered conditions in the industry. In a limited manner the table reflects these changes. While the number of establishments engaged in the construction of ships did not increase materially during the fifty-five years, the capital invested in the industry increased twenty-one fold and the value of the product nearly fourfold. These changes indicate that, as the construction of iron and steel ships has grown in importance, capital has become far more essential to the development of the industry than was the case when ships were constructed of wood only.

Since 1900 the number of shipbuilding plants has apparently decreased, notwithstanding that in the other statistical items of importance there were substantial gains. In a measure this is explained by the fact that at the census of 1900 a number of small boat builders and repairers were included that did not prove of sufficient importance to be included in the factory census of 1905. The operations of the establishments omitted on this account, however, were inconsiderable and consequently their omission does not affect materially the other statistical items shown in the table. At the census of 1880 there were practically twice as many establishments engaged in the industry as at the census of 1905. This fact, taken in conjunction with the increase in capital and products, shows the progressive concentration of shipbuilding in large establishments made necessary by the altered conditions in the industry, to which reference has already been made.

The capital invested in the industry increased during the years between 1900 and 1905 at a far greater rate than the value of the products. This condition was more marked than that which characterized the industry during the previous intercensal period, and it is explained by the extremely unsatisfactory state of the shipbuilding industry during 1904, which was especially marked in the shipbuilding operations on the Great Lakes. Owing to this depression it is probable that the increase in the capital invested is a truer index to the progress of the industry since 1900 than the value of the products.

Branches of the industry.—In Table 2 are shown separately the operations of private establishments engaged primarily in the construction of iron and steel vessels, and those building principally wooden ships and boats, at the censuses of 1900 and 1905.

Table 2.—COMPARATIVE SUMMARY, BY BRANCHES: 1905 AND 1900.

	1905					1900					PER CENT OF INCREASE.	
	Total.	Iron and steel.	Per cent of total.	Wooden.	Per cent of total.	Total.	Iron and steel.	Per cent of total.	Wooden.	Per cent of total.	Iron and steel.	Wooden.
Number of establishments	1,097	54	4.9	1,043	95.1	1,107	44	4.0	1,063	96.0	22.7	[1]1.9
Capital	$121,623,700	$101,528,251	83.5	$20,095,449	16.5	$77,341,001	$59,839,555	77.4	$17,501,446	22.6	69.7	14.8
Salaried officials, clerks, etc., number	2,480	1,770	71.4	710	28.6	1,405	857	61.0	548	39.0	106.5	29.6
Salaries	$3,339,741	$2,544,297	76.2	$795,444	23.8	$2,007,237	$1,411,863	70.3	$595,374	29.7	80.2	33.6
Wage-earners, average number	50,754	36,742	72.4	14,012	27.6	46,747	30,906	66.1	15,841	33.9	18.9	[1]11.5
Total wages	$29,241,087	$20,809,908	71.2	$8,431,179	28.8	$24,824,738	$16,231,311	65.4	$8,593,427	34.6	28.2	[1]1.9
Miscellaneous expenses	$5,255,506	$3,767,620	71.7	$1,487,886	28.3	$3,684,811	$2,642,690	71.7	$1,042,121	28.3	42.6	42.8
Cost of materials used	$37,463,179	$27,601,824	73.7	$9,861,355	26.3	$33,474,896	$23,585,549	70.5	$9,889,347	29.5	17.0	[1]0.3
Value of products, including repair work	$82,769,239	$58,433,314	70.6	$24,335,925	29.4	$74,532,277	$50,367,739	67.6	$24,164,538	32.4	16.0	0.7

[1] Decrease.

The notable feature of the table is the increase in the capital invested in iron and steel shipbuilding. This increase amounted to $41,688,696, which was more than twice the amount invested in wooden shipbuilding at the census of 1905. It is not surprising, therefore, that at the later census the capital invested in the iron and steel branch of the industry constituted 83.5 per cent of the total capital invested in shipbuilding.

The division of the number of establishments engaged in shipbuilding between the two branches of the industry is more disproportionate than the division of capital, the establishments engaged in wooden construction work constituting 95.1 per cent of the total number. This fact, taken in conjunction with the division of the capital, indicates clearly the dissimilar character of the operations of each. The great majority of the establishments engaged in the construction of iron and steel vessels are of great size, requiring the most costly and extensive equipment; whereas a large proportion of the establishments engaged in wooden construction work are small yards which perform minor repairs on small vessels and turn out wooden vessels of comparatively small tonnage.

It is evident that the depression which characterized the industry in 1904 fell more heavily upon the establishments engaged in iron and steel construction work than upon those engaged in wooden construction work. The following tabular statement, which presents the average capital and average value of the product per establishment for both branches of the industry at the last two censuses, illustrates this fact more clearly than Table 2:

	AVERAGE PER ESTABLISHMENT.			
	1905		1900	
	Capital.	Value of products.	Capital.	Value of products.
Iron and steel	$1,880,153	$1,082,098	$1,359,990	$1,144,721
Wooden	19,267	23,333	16,464	22,732

The statement shows that the productivity of the capital invested in the average establishment engaged

in wooden shipbuilding at the census of 1900, when conditions were fairly normal, continued practically unaffected by the depression at the census of 1905; whereas in the case of the average establishment in the iron and steel branch of the industry the decline in the productivity of the capital plainly reflects the unnatural conditions at the later census, indicating that a large proportion of the capital was idle.

Materials used.—Table 3 shows the cost of materials used at the censuses of 1890, 1900, and 1905, distributed according to kind.

The growth in importance of iron and steel as materials in shipbuilding is well illustrated by the table. At the census of 1890 the cost of iron and steel constituted a less important item in the expenditure for materials than the cost of lumber, but at the census of 1905, the cost of the former item constituted 41.2 per cent and the cost of the latter only 17.9 per cent of the amount paid out for materials.

The decrease in wooden shipbuilding is further indicated by the decrease since 1900 in the amount of money expended for cordage, masts and spars, blocks, oakum and pitch—materials which belong particularly to that branch.

TABLE 3.—*Materials used, by kind and cost, with per cent of total: 1890 to 1905.*

KIND.	1905		1900		1890	
	Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.
Total	$37,463,179	100.0	$33,474,896	100.0	[1]$16,925,109	100.0
Iron and steel materials [2]	15,417,500	41.2	14,112,436	42.1	4,872,074	28.8
Lumber, all kinds	6,700,087	17.9	6,224,974	18.6	5,995,894	35.4
Machinery and boilers, purchased	4,548,482	12.1	3,082,677	9.2	2,913,856	17.2
Cordage—wire, manila, and hemp	490,130	1.3	531,497	1.6	309,270	1.8
Masts and spars, purchased	174,047	0.4	223,353	0.7	204,365	1.2
Calking materials, oakum, pitch, etc.	251,671	0.7	275,236	0.8	227,994	1.4
Blocks, purchased	82,316	0.2	85,214	0.3	74,927	0.4
All other materials [3]	9,798,946	26.2	8,939,509	26.7	2,326,729	13.8

[1] Includes $403,863 reported by governmental establishments.
[2] Includes plates, beams, angles, forgings, rivets, castings, nails, spikes, bolts, etc.; pig and scrap iron; yellow metal; copper, sheets and pipes; and anchors and chains, purchased.
[3] Includes fittings and furniture; paints, oils, and other materials not specified; fuel; rent of power and heat; mill supplies; and freight.

Products.—In Table 4 is presented the value of products distributed by kind for each census from 1880 to 1905.

TABLE 4.—PRODUCTS, BY KIND AND VALUE, WITH PER CENT OF TOTAL: 1880 TO 1905.

KIND.	1905		1900		1890		1880	
	Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.
Total	$82,769,239	100.0	$74,532,277	100.0	$38,065,410	100.0	$36,800,327	100.0
Vessels of 5 tons and over:								
Iron and steel construction	43,395,704	52.4	25,454,943	34.2	11,550,846	30.3	5,096,293	13.8
Wooden construction	9,724,231	11.8	10,295,530	13.8	12,933,149	34.0	14,129,421	38.4
Small boats under 5 tons	3,001,292	3.6	1,968,835	2.6	1,392,084	3.7	876,999	2.4
Repair work	22,829,040	27.6	23,134,436	31.0	10,012,389	26.3	16,697,614	45.4
All other products	3,818,972	4.6	13,678,533	18.4	2,176,942	5.7	(1)	....

[1] Not reported separately.

Table 4 shows the rapid growth in iron and steel construction during the past twenty-five years. In marked contrast is the decrease in wooden construction during the period. At the census of 1880 the value of the work done upon wooden vessels of 5 tons and over was nearly three times as great as the value of work done upon iron and steel vessels of the same class, but a quarter of a century later conditions were reversed and the value of work done on vessels constructed of iron and steel was over four times that of work done on vessels built of wood.

The increase since 1900 of $1,032,457, or 52.4 per cent, in the production of boats under 5 tons is a notable feature of the table. This increase is due to the demand for small boats, both for business and pleasure, driven by internal combustion engines, and has resulted naturally from marked improvements in engines of this type which have made them most adaptable and efficient sources of power for the propulsion of small boats.

The noticeable falling off in the value of "all other products" is due largely to the increasing tendency among shipbuilders to eliminate minor products and to confine themselves to the principal products of the industry. Many of the minor materials necessary in ship construction are now manufactured in large quantities by establishments specializing in their production, and it is cheaper for the shipbuilder to buy them in the open market than to produce them himself.

Table 5 presents the states which led in the shipbuilding industry at the census of 1905, ranked according to capital and value of products reported at each census during the past twenty-five years.

TABLE 5.—*Rank, according to capital and value of products, of states having products valued at one million dollars and over for 1905: 1880 to 1905.*

STATE.	RANK ACCORDING TO—							
	Capital.				Value of products.			
	1905	1900	1890	1880	1905	1900	1890	1880
California	9	4	6	3	5	3	5	7
Connecticut	15	16	12	12	7	16	11	13
Delaware	11	11	7	7	13	11	9	5
Maine	14	9	10	8	9	8	6	[illegible]
Maryland	7	6	8	5	8	7	10	8
Massachusetts	6	12	9	4	6	10	8	4
Michigan	8	7	2	9	11	6	2	6
New Jersey	5	8	5	6	4	5	7	10
New York	4	3	1	2	1	2	1	1
Ohio	2	5	3	11	10	9	3	9
Pennsylvania	3	2	4	1	2	1	4	2
Virginia	1	1	18	17	3	4	18	22
Washington	10	14	21	23	12	13	21	21

Of the leading states shown in the table, New York and Pennsylvania appear to have undergone the least marked variations in rank, and in both capital and value of product each has held the first rank or has been very close to the leader throughout the quarter of a century. The leadership of these two states has been most marked in the value of the product, New York having been first at three of the four censuses and second in 1900, when Pennsylvania led. The most marked progress appears to have been made by Virginia, which during the twenty-five years rose from twenty-second to third rank in value of products and from seventeenth to first rank in capital invested.

The Pacific Coast district is represented by California and Washington, of which the former has held an important position in the industry throughout the period shown, while the latter is evidently making rapid progress. Of the states on the Great Lakes, Ohio and Michigan are the leaders, the former being second in capital and tenth in value of the product at the census of 1905.

The industry by watershed districts.—Table 6 shows the distribution of the totals for the United States, by watershed districts, at the census of 1905.

TABLE 6.—SUMMARY, BY WATERSHED DISTRICTS, WITH PER CENT OF TOTAL: 1905.

	Aggregate.	ATLANTIC AND GULF.		GREAT LAKES.		MISSISSIPPI VALLEY.		PACIFIC COAST.	
		Total.	Per cent of aggregate.	Total.	Per cent of aggregate.	Total.	Per cent of aggregate.	Total.	Per cent of aggregate.
Number of establishments	1,097	717	65.4	178	16.2	107	9.7	95	8.7
Capital	$121,623,700	$80,592,683	66.3	$31,790,403	26.1	$2,019,344	1.7	$7,231,270	5.9
Salaried officials, clerks, etc., number	2,480	1,728	69.7	404	16.3	108	4.3	240	9.7
Salaries	$3,339,741	$2,395,951	71.8	$415,150	12.4	$124,449	3.7	$404,191	12.1
Wage-earners, average number	50,754	37,919	74.7	5,743	11.3	1,610	3.2	5,482	10.8
Total wages	$29,241,087	$21,179,467	72.4	$3,221,290	11.0	$946,945	3.3	$3,893,385	13.3
Miscellaneous expenses	$5,255,506	$3,870,709	73.6	$845,717	16.1	$151,475	2.9	$387,605	7.4
Cost of materials used	$37,463,179	$28,535,838	76.1	$3,582,340	9.6	$998,242	2.7	$4,346,759	11.6
Products, total value	$82,769,239	$61,019,911	73.7	$9,376,940	11.3	$2,606,466	3.2	$9,765,922	11.8
Vessels of 5 tons and over	$53,119,935	$41,327,309	77.8	$4,870,104	9.2	$895,537	1.7	$6,026,985	11.3
Small boats under 5 tons	$3,001,292	$1,654,509	55.1	$832,753	27.8	$311,958	10.4	$202,072	6.7
Repair work	$22,829,040	$15,287,355	67.0	$3,293,215	14.4	$1,168,251	5.1	$3,080,219	13.5
All other products	$3,818,972	$2,750,738	72.0	$380,868	10.0	$230,720	6.0	$456,646	12.0

At the census of 1905 nearly three-fourths of the aggregate value of the products of the shipbuilding industry was produced by the establishments located in the Atlantic and Gulf district. The number of establishments engaged in the industry in the Great Lakes district was nearly double the number of shipbuilding plants in the Pacific Coast district, but the value of the output of the latter was slightly greater than that of the former district. In the Great Lakes district a much greater number of small vessels of less than 5 tons are built than is the case in the Pacific Coast district, and it is natural, therefore, that there should be a larger number of small establishments the products of which are in no way comparable from the standpoint of value to those of the great shipyards on the western coast, which in two cases at least build war ships of the largest size.

It would appear from the table that for the products aggregating approximately the same value, over four times as much capital is required in the Great Lakes district as in the Pacific Coast district. This is explained in part by the fact that the returns of capital for the establishments in the Great Lakes district included numerous dry docks aggregating a far greater value than was reported for this item of fixed capital by establishments in the Pacific Coast district, and in part by the inclusion of a class of assets by one of the largest establishments on the Lakes, amounting to several millions of dollars, which did not appear in the capital of any of the large shipbuilding plants on the Pacific Coast. Finally, it is probable that owing to the depression which characterized the industry during the census year, a larger percentage of the capital employed in shipbuilding on the Great Lakes was unproductive than was the case on the Pacific Coast, where the construction of Government war ships formed at that time the greater proportion of the work performed by the largest shipbuilders on the coast. One large company on the Lakes was practically without construction work during August, 1904, and the entire year in this district up to the closing months was one of unusual depression in the industry.

The unsatisfactory conditions prevailing in the shipbuilding industry on the Great Lakes during the census year is further disclosed in Table 7, which compares the returns made by establishments in the two branches of the industry on the Great Lakes at the censuses of 1900 and 1905.

TABLE 7.—COMPARATIVE SUMMARY FOR THE GREAT LAKES DISTRICT, BY BRANCHES, WITH PER CENT OF INCREASE: 1905 AND 1900.

	IRON AND STEEL.			WOODEN.		
	1905	1900	Per cent of increase.	1905	1900	Per cent of increase.
Number of establishments	11	8	37.5	167	114	46.5
Capital	$28,556,593	$12,509,788	128.3	$3,233,810	$2,675,385	20.9
Salaried officials, clerks, etc., number	286	140	104.3	118	77	53.2
Salaries	$307,030	$230,330	33.3	$108,120	$76,657	41.0
Wage-earners, average number	3,910	6,388	[1]38.8	1,833	2,129	[1]13.9
Total wages	$2,279,704	$3,130,005	[1]27.2	$941,586	$1,201,060	[1]21.6
Miscellaneous expenses	$617,574	$405,446	52.3	$228,143	$151,020	51.1
Cost of materials used	$2,653,053	$4,003,854	[1]33.7	$929,287	$962,396	[1]3.4
Products, total value	$6,815,261	$9,247,305	[1]26.3	$2,561,679	$2,706,549	[1]5.4
Vessels of 5 tons and over	$4,382,456	$5,183,628	[1]15.5	$487,648	$679,804	[1]28.3
Small boats under 5 tons	$80,000			$752,753	$333,034	126.0
Repair work	$2,196,987	$2,028,639	8.3	$1,096,228	$1,617,307	[1]32.2
All other products	$155,818	$2,035,038	[1]92.3	$225,050	$76,404	194.6

[1] Decrease.

Both the number of establishments and the capital invested in them increased during the intercensal period, but with respect to all the remaining items of importance shown in the table marked decreases appear for both iron and steel and wooden shipbuilding. The decreases were particularly marked in the iron and steel branch of the industry, the value of the product falling off over one-fourth of the value of the output for 1900. Some idea of the depression in the industry which marked the census year 1904 may be obtained from the report of the Commissioner of Navigation for the fiscal year ending June 30, 1904, from which it appears that on July 1, 1904, practically no construction work was in progress in the lake region. When this condition is contrasted with 26 steel ships with an aggregate tonnage of 103,667 tons reported to the Commissioner of Navigation as under construction in shipbuilding plants on the Great Lakes, July 1, 1905, conditions in the industry during 1904 are brought plainly into view. The losses disclosed by Table 7, then, were due to a temporary derangement of the industry which unfortunately occurred in the census year. As a matter of fact the increases in the number of establishments and capital invested in the industry may properly be taken to indicate that shipbuilding on the Great Lakes is increasing instead of decreasing.

GOVERNMENTAL ESTABLISHMENTS.

Government navy yards engaged in shipbuilding and repair work during the census year, listed in the order of the magnitude of their operations, were as follows:

Brooklyn navy yard	New York, N. Y.
Boston navy yard	Boston, Mass. (Charlestown).
Navy yard and station	Norfolk, Va.
Mare Island navy yard	Vallejo, Cal.
Puget Sound navy yard	Bremerton, Wash.
League Island navy yard	Philadelphia, Pa.
Portsmouth navy yard	Portsmouth, N. H. (Kittery, Me.).
Navy yard	Pensacola, Fla.
Naval station	Port Royal, S. C.

Table 8 is a comparative summary of the operations of these 9 navy yards for 1905 and the operations of the 8 yards reported as engaged in the industry at the census for 1900.

TABLE 8.—*Governmental establishments—comparative summary, with per cent of increase: 1905 and 1900.*

	1905	1900	Per cent of increase.
Number of establishments	9	8	12.5
Capital	$56,921,404	$54,280,511	4.9
Salaried officials, clerks, etc., number	567	539	5.2
Salaries	$699,062	$464,997	50.3
Wage-earners, average number	12,204	7,684	58.8
Total wages	$9,722,764	$6,217,955	56.4
Miscellaneous expenses	$111,712	$29,064	284.4
Cost of materials used	$6,731,931	$3,802,345	77.0
Value of products, including repair work	$17,265,469	$11,022,312	56.6

An increasing navy has compelled the Government to equip the navy yards adequately for the repair work necessarily resulting from the larger number of new vessels now continually in commission. In addition Government yards are also undertaking the construction of the largest types of war ships, one of which was completed during 1904, and the increase in value of products revealed by the table reflects these conditions.

VESSELS LAUNCHED, SMALL BOATS, AND REPAIR WORK.

In the preceding sections of this report the statistics presented for the shipbuilding industry include only the value of work done during the census year. In the following tables statistics are presented concerning vessels launched during the year, irrespective of the time taken in their construction.

In explanation of a number of the tables which follow, wherein tonnage is shown, it should be said that gross and net tonnage is the gross and net load capacity of a vessel in tons. By methods prescribed by law, now practically uniform for the leading maritime countries, the hull of a vessel is carefully measured and the total capacity in cubic feet is ascertained. This quantity is

then divided by 100, which gives the gross tonnage of the vessel. In order to obtain the net tonnage the space occupied by the quarters of the crew and officers, by the machinery—boilers, engines, etc.—by the gear used in navigation, and by the double bottom, when not available for cargo, stores, or fuel, is deducted from the total capacity of the hull in cubic feet and the result divided by 100. Differing from these two measures is the displacement tonnage of a vessel. Displacement tonnage is merely the weight of the volume of water displaced, which is equal to the weight of the floating vessel and its load. It is necessary, therefore, in referring to the displacement of a vessel to specify under what conditions, whether with or without load, the displacement is calculated. The tonnage of war vessels of the United States Navy is always given in displacement tonnage, which is the weight of the vessel in ordinary cruising condition. While gross tonnage and displacement tonnage are thus not by any means the same, it is necessary to combine the two in order to obtain a total which will approximately represent the total tonnage launched during the year. This method has been followed in this report wherever Government vessels are shown with merchant vessels.

In the tables which follow tonnage shown for 1905 is gross unless otherwise specified. It is impossible to indicate for previous censuses the quantity of displacement tonnage included in the figures, but owing to the fact that the building of Government war ships has only recently become prominent in the industry, it is probable that for censuses prior to the census of 1900 displacement tonnage formed a comparatively small proportion of the totals shown in the tables.

Vessels of 5 tons and over.—In Table 9 is presented the number of iron and steel vessels and the number of wooden vessels launched by private yards, together with their tonnage and value, as reported at each census from 1880 to 1905.

TABLE 9.—NUMBER, TONNAGE, AND VALUE OF VESSELS OF FIVE TONS AND OVER LAUNCHED BY PRIVATE SHIPYARDS, WITH PER CENT OF INCREASE: 1880 TO 1905.

CLASS.	CENSUS.				PER CENT OF INCREASE.		
	1905	1900	1890	1880	1900 to 1905	1890 to 1900	1880 to 1890
All classes:							
Number of vessels	[1]2,248	2,081	1,353	2,415	8.0	53.8	[2]44.0
Tonnage	[3]700,852	687,159	484,640	498,878	2.0	41.8	[2]2.9
Value	$73,471,026	$35,750,473	$24,483,995	$19,225,714	105.5	46.0	27.4
Iron and steel:							
Number	155	134	88	67	15.7	52.3	31.3
Tonnage	[4]328,819	262,516	123,973	31,347	25.3	111.8	295.5
Value	$63,682,960	$25,454,943	$11,550,846	$5,096,293	150.2	120.4	126.7
Wooden:							
Number	2,093	1,947	1,265	2,348	7.5	53.9	[2]46.1
Tonnage	[5]372,033	424,643	360,667	467,531	[2]12.4	17.7	[2]22.9
Value	$9,788,066	$10,295,530	$12,933,149	$14,129,421	[2]4.9	[2]20.4	[2]8.5

[1] Includes 134 vessels of 22,327 gross tonnage, valued at $463,018, which were launched by establishments engaged primarily in the manufacture of other products.
[2] Decrease.
[3] Includes 174,505 tons displacement—Government vessels.
[4] Includes 169,803 tons displacement—Government vessels.
[5] Includes 4,702 tons displacement—Government vessels.

Comparison of tonnage and value of vessels launched, as reported for 1905, can not be made with the statistics for prior censuses without important reservations. As previously stated, the value ($53,119,935) reported for 1905 for vessels of 5 tons and over, in the general tables, represents only the value of the work done during the census year, while the value ($73,471,026) in Tables 9 and 14 represents the total value or contract price of the vessels launched during that time. The difference ($20,351,091) is occasioned largely by the great amount of construction work on war vessels for the Government, which required more than one year to complete. At prior censuses the value of the year's work was not reported separately, and although Government construction was not so prominent a feature, it is impossible to say to what extent the totals at those censuses are not strictly comparable with those for the census of 1905.

Although the number of ships launched as reported at the census of 1905 was less by 167 than the number launched twenty-five years before, yet the tonnage increased 40.5 per cent during the period, and the average tonnage of the vessels launched, 50.9 per cent. In this connection it is interesting to note that the average value of the vessels launched in 1880 was only $7,961, whereas in 1905 the average was $32,683.

Since 1900 the increases in tonnage and in number have been slight but the value of the ships launched more than doubled. Tables 10 and 11 throw some light on the unusual increase in this item.

Table 10.—*Number, tonnage, and value of vessels of five tons and over launched during 1904 by all establishments, classified according to service.*

CLASS.	Aggregate.	Merchant service.	GOVERNMENT SERVICE.		
			Total.	By private shipyards.	By Government shipyards.
All classes:					
Number	[1] 2,279	2,195	84	53	31
Tonnage	728,104	526,347	[2] 201,757	174,505	27,252
Value	$79,918,035	$31,172,592	$48,745,443	$42,298,434	$6,447,009
Iron and steel:					
Number	172	121	51	34	17
Tonnage	352,669	159,016	[2] 193,653	169,803	23,850
Value	$69,944,092	$21,978,001	$47,966,091	$41,704,959	$6,261,132
Wooden:					
Number	2,107	2,074	33	19	14
Tonnage	375,435	367,331	[2] 8,104	4,702	3,402
Value	$9,973,943	$9,194,591	$779,352	$593,475	$185,877

[1] Includes 134 vessels of 22,327 gross tonnage, valued at $463,018, which were launched by establishments engaged primarily in the manufacture of other products.
[2] Displacement tonnage.

Table 10 shows that although only 3.7 per cent of the total number of vessels launched during 1904 were destined for Government service, yet these vessels represented 27.7 per cent of the tonnage and 61 per cent of the aggregate value of all vessels launched.

Of the 53 ships launched for the Government by private yards, 13 were war ships of 1,000 tons and over, as shown in Table 11, aggregating 154,170 tons displacement and a contract value of $39,513,600. Referring to Table 10, it will be seen that the value of these war ships constituted over one-half of the value of vessels of 5 tons and over of all descriptions launched by private establishments during 1904, and that this value was greater by $3,763,127 than the value of vessels of 5 tons and over of all descriptions launched by private yards at the census of 1900. It is evident, therefore, that the great increase in value since 1900 has resulted largely from the unusual activity in construction work for the Navy.

Table 11.—STEEL VESSELS OF 1,000 TONS AND OVER FOR THE UNITED STATES NAVY LAUNCHED DURING 1904 BY PRIVATE SHIPYARDS.[1]

NAME OF VESSEL.	Type.	Builder.	Place of construction.	Normal displacement (tons).	Contract price.
Total				154,170	$39,513,600
Georgia	First-class battle ship	Bath Iron Works	Bath, Me	14,948	3,590,000
Louisiana	First-class battle ship	Newport News Shipbuilding Co	Newport News, Va	16,000	3,990,000
Nebraska	First-class battle ship	Moran Bros	Seattle, Wash	14,948	3,733,600
New Jersey	First-class battle ship	Fore River Shipbuilding Co	Quincy, Mass	14,948	3,405,000
Rhode Island	First-class battle ship	Fore River Shipbuilding Co	Quincy, Mass	14,948	3,405,000
Virginia	First-class battle ship	Newport News Shipbuilding Co	Newport News, Va	14,948	3,590,000
California	Armored cruiser	Union Iron Works	San Francisco, Cal	13,680	3,800,000
South Dakota	Armored cruiser	Union Iron Works	San Francisco, Cal	13,680	3,750,000
Tennessee	Armored cruiser	Wm. Cramp & Sons	Philadelphia, Pa	14,500	4,035,000
Charleston	Protected cruiser	Newport News Shipbuilding Co	Newport News, Va	9,700	2,740,000
Milwaukee	Protected cruiser	Union Iron Works	San Francisco, Cal	9,700	2,825,000
Dubuque	Gunboat	Gas Engine and Power Co. and Chas. L. Seabury Co. Cons.	Morris Heights, N. Y	1,085	295,000
Paducah	Gunboat	Gas Engine and Power Co. and Chas. L. Seabury Co. Cons.	Morris Heights, N. Y	1,085	355,000

[1] Annual Report of the Chief of the Bureau of Construction and Repair, United States Navy Department, 1905.

To supplement the information in Table 11, the displacement tonnage of vessels of 1,000 tons and over launched during 1904 from Government yards is shown in Table 12.

Table 12.—*Steel vessels of 1,000 tons and over launched during 1904 by Government shipyards.*[1]

NAME.	Type.	Place of construction.	Normal displacement (tons).	Value.
Total			19,600	$4,952,000
Connecticut	First-class battle ship	Brooklyn navy yard	16,000	4,212,000
Cumberland	Steel training bark	Boston	1,800	370,000
Intrepid	Steel training bark	Mare Island navy yard	1,800	370,000

[1] Annual Report of the Chief of the Bureau of Construction and Repair, United States Navy Department, 1905.

If the displacement tonnage of the war ships in Table 11 be added to the displacement of the battle ship *Connecticut* shown in Table 12, the aggregate, 170,170 tons (displacement), will represent the tonnage output of war ships of 1,000 tons and over for the year.

Table 13 shows the net tonnage of the vessels launched for the merchant marine of the United States, at the census of 1905.

Table 13.—*Net tonnage of merchant vessels of five tons and over launched during 1904 by private shipyards, classified according to kind of trade, by geographic divisions.*

DIVISION.	Total net tonnage.	NET TONNAGE OF VESSELS BUILT FOR—			
		Foreign trade.	Coastwise trade.	Lake and river trade.	Canal trade.
United States	450,614	23,504	115,699	306,003	5,408
North Atlantic	292,121	22,140	90,887	174,018	5,076
South Atlantic	45,453	840	9,274	35,105	234
North Central	70,130	19		70,111	
South Central	20,250	195	2,000	17,957	98
Western	22,660	310	13,538	8,812	

The table plainly indicates the importance of lake and river traffic to the shipbuilding of this country. Of the total net tonnage launched for the merchant marine of the United States during the census year, 67.9 per cent was destined for this trade. Vessels for

coastwise and lake and river service are required by law to be American built. This fact has made it possible for shipbuilding to maintain a firm footing in this country.

Of the total net tonnage of merchant vessels launched during the census year 64.8 per cent was built in shipyards of the North Atlantic division, which comprises the New England states, and New York, New Jersey, and Pennsylvania. Of the total net tonnage launched by shipyards in this division, 59.6 per cent was intended for the lake and river trade.

The comparative unimportance of shipbuilding for foreign trade in the United States is indicated by the fact that of the total net tonnage launched for merchant service, only 5.2 per cent was destined for this trade, nearly the whole of which was built in the shipyards of the North Atlantic division.

In Table 14 is presented the number, tonnage, and value of vessels of 5 tons and over launched by private shipyards classified according to motive power, as reported at each census from 1880 to 1905, with percentages of increase.

TABLE 14.—NUMBER, TONNAGE, AND VALUE OF VESSELS OF FIVE TONS AND OVER LAUNCHED BY PRIVATE SHIPYARDS, CLASSIFIED ACCORDING TO MOTIVE POWER, WITH PER CENT OF INCREASE: 1880 TO 1905.

CLASS.	CENSUS.				PER CENT OF INCREASE.		
	1905	1900	1890	1880	1900 to 1905	1890 to 1900	1880 to 1890
All classes:							
Number	[1] 2,248	2,081	1,353	2,415	8.0	53.8	[2] 44.0
Tonnage	[3] 700,852	687,159	484,640	498,878	2.0	41.8	2.9
Value	$73,471,026	$35,750,473	$24,483,995	$19,225,714	105.5	46.0	27.4
Steam and other power vessels:							
Number	625	519	369	(4)	20.4	40.7	....
Tonnage	[3] 353,314	286,311	217,185	(4)	23.4	31.8	....
Value	$66,029,538	$27,305,701	$16,866,068	(4)	141.8	61.9	....
Barges:							
Number	1,244	844	400	(4)	47.4	111.0	....
Tonnage	277,310	299,560	123,436	(4)	[2] 7.4	142.7	....
Value	$3,722,069	$4,009,170	$1,773,186	(4)	[2] 7.2	126.1	....
Sail vessels:							
Number	349	648	314	(4)	[2] 46.1	106.4	....
Tonnage	64,615	80,294	103,710	(4)	[2] 19.5	[2] 22.6	....
Value	$3,620,119	$4,210,228	$5,340,941	(4)	[2] 14.0	[2] 21.2	....
Canal boats:							
Number	30	70	270	643	[2] 57.1	[2] 74.1	[2] 58.0
Tonnage	5,613	20,994	40,309	66,707	[2] 73.3	[2] 47.9	[2] 39.6
Value	$99,300	$225,374	$503,800	$1,739,975	[2] 55.9	[2] 55.3	[2] 71.0

[1] Includes 134 vessels of 22,327 gross tonnage, valued at $463,018, which were launched by establishments engaged primarily in the manufacture of other products.
[2] Decrease.
[3] Includes 174,505 tons displacement—Government vessels.
[4] Not reported separately.

The decrease since 1890 in tonnage and value of sail vessels is a marked feature of the table. The decreases in these items, taken in conjunction with a slight increase during the fifteen years in the number of vessels launched, indicate a falling off in the average size and value of vessels of this class.

In Table 15 the activity in shipbuilding of the watershed districts of the United States at the census of 1905 is indicated by the number, tonnage, and value of vessels launched from the private shipyards in each district, classified according to motive power.

In every class of vessels shown in the table the shipyards in the Atlantic and Gulf district launched vessels aggregating a greater tonnage and value than the combined totals for the shipyards in the other districts. Although the Great Lakes district outranked the Pacific Coast in tonnage the value of the vessels launched from the shipyards in the latter district was over three times as great as the value of the vessels launched in the former. This difference was due to the fact that 65.8 per cent of the tonnage launched in the Pacific Coast district was displacement tonnage of war vessels, the value of which per ton was much greater than the average tonnage value of the vessels launched in the Great Lakes district, which were practically all freight and passenger steamers for lake traffic. In fact, the tonnage of ships built for the merchant marine by shipyards on the Great Lakes was nearly three times as great as that built for merchant service on the Pacific Coast. In the same way the ascendancy of the Atlantic and Gulf district over the Great Lakes in the tonnage of steam vessels launched is due largely to the inclusion of the displacement tonnage of war ships built on the Atlantic Coast. If the displacement tonnage were eliminated from the figures for the Atlantic and Gulf district, the remaining gross tonnage would be only 17,477 tons in excess of the gross tonnage of the steam vessels launched in the Great Lakes district. As has already been pointed out in this report, shipbuilding on the Great Lakes was at a very low ebb during the census year, and thus the table does not show a normal year's output. There is no doubt, therefore, that under normal conditions the tonnage output of steam vessels for the merchant marine is much greater in the Great Lakes district than for any of the other watershed districts.

TABLE 15.—*Number, tonnage, and value of vessels of five tons and over launched during 1904 by private shipyards, classified according to motive power, by watershed districts.*[1]

CLASS.	Atlantic and Gulf.	Great Lakes.	Mississippi Valley.	Pacific Coast.
All classes:				
Number	1,238	160	612	238
Tonnage	[2] 449,641	[3] 81,379	90,194	[4] 79,638
Value	$52,256,195	$4,557,067	$875,843	$15,781,921
Steam vessels:				
Number	208	31	26	49
Tonnage	[2] 206,813	[3] 68,684	9,390	[4] 65,180
Value	$45,789,186	$4,112,639	$403,800	$15,244,745
Barges and canal boats:				
Number	591	28	570	85
Tonnage	185,646	6,085	80,628	10,564
Value	$3,048,104	$136,953	$460,149	$176,163
Sail vessels:				
Number	292	36	(5)	21
Tonnage	55,523	5,712	(5)	3,380
Value	$3,150,497	$225,245	(5)	$244,377
Power vessels, other than steam:				
Number	147	65	16	83
Tonnage	1,659	898	176	514
Value	$268,408	$82,230	$11,894	$116,636

[1] Includes 134 vessels of 22,327 gross tonnage. valued at $463,018, which were launched by establishments engaged primarily in the manufacture of other products.
[2] Includes 121,367 tons displacement—Government vessels.
[3] Includes 715 tons displacement—Government vessels.
[4] Includes 52,423 tons displacement—Government vessels.
[5] Two sail vessels included in figures for Pacific Coast district, to avoid dis-closing individual operations.

Table 16 shows the output of the Great Lakes in steel and wooden vessels at the censuses of 1900 and 1905.

TABLE 16.—*Number, tonnage, and value of steel and wooden vessels of five tons and over launched by private shipyards on the Great Lakes, with per cent of increase: 1905 and 1900.*

CLASS.	1905	1900	Per cent of increase.
All classes:			
Number	160	128	25.0
Gross tonnage	[1] 81,379	111,241	[2] 26.8
Net tonnage	62,869	86,942	[2] 27.7
Value	$4,557,067	$5,863,432	[2] 22.3
Steel vessels:			
Number	24	24	....
Gross tonnage	69,400	96,328	[2] 28.0
Net tonnage	51,479	74,229	[2] 30.6
Value	$4,100,782	$5,183,628	[2] 20.9
Wooden vessels:			
Number	136	104	30.8
Gross tonnage	11,979	14,913	[2] 19.7
Net tonnage	11,390	12,713	[2] 10.4
Value	$456,285	$679,804	[2] 32.9

[1] Includes 715 tons displacement—Government vessels. [2] Decrease.

In view of what has already been said it will be understood that the losses which the table appears to indicate were due to a temporary depression in the industry and not to an actual decrease during the intercensal period.

In Table 17 the states from whose shores vessels valued at a million dollars or over were launched at the census of 1905, are ranked according to the value of vessels launched, for the censuses of 1900 and 1905.

At the census of 1900 the first four places were held by states on the Atlantic coast—Pennsylvania, Maine, Virginia, and New York, in the order named—the fifth by Michigan, on the Great Lakes, and the sixth by California, on the Pacific Coast. Five years later the rank of each of the 6 leading states underwent a change, with the exceptions of Pennsylvania and Virginia, which held first and third places, respectively, at both censuses; California rising to second place; Massachusetts supplanting New York in fourth place; Maine dropping to fifth place; and the state of Washington rising from eleventh to sixth place.

In the majority of cases the rank for steel vessels coincides or closely approximates the rank for all classes, indicating that the production of this class of vessels controls in general the rank of the state in shipbuilding. An exception in this respect exists in the case of Maine. At both censuses this state held the primacy in the building of wooden vessels, and at the census of 1900 the high rank of the state in the shipbuilding industry was due evidently to this fact.

In the launching of steel vessels Washington shows a truly remarkable rise in importance. From a position of insignificance in 1900 the state reached fifth place in this important branch of the industry at the census of 1905. The rise of Massachusetts in the production of steel vessels during the intercensal period was also notable.

TABLE 17.—*Rank of principal states according to value of vessels of five tons and over launched by private shipyards: 1905 and 1900.*

STATE.	ALL CLASSES.		STEEL VESSELS.		WOODEN VESSELS.	
	1905	1900	1905	1900	1905	1900
California	2	6	3	7	5	3
Connecticut	8	15	8	....	3	5
Delaware	13	7	13	4	8	12
Maine	5	2	7	11	1	1
Maryland	11	8	12	5	6	11
Massachusetts	4	12	4	12	7	6
Michigan	10	5	9	3	12	8
New Jersey	7	10	6	10	10	7
New York	9	4	10	8	2	2
Ohio	12	9	11	6	17	14
Pennsylvania	1	1	1	1	9	15
Virginia	3	3	2	2	16	28
Washington	6	11	5	16	4	4

Table 18 presents the states shown in Table 17, ranked according to the value of vessels launched at the census of 1905, distributed according to the motive power used.

TABLE 18.—*Rank of principal states according to value of each class of vessels of five tons and over launched during 1904 by private shipyards.*

STATE.	All classes.	Steam vessels.	Barges.	Sail vessels.	Power vessels other than steam.	Canal boats.
California	2	2	12	8	2	....
Connecticut	8	8	2	5	17	....
Delaware	13	13	6	9	....	....
Maine	5	6	10	1	9	....
Maryland	11	12	3	12	4	3
Massachusetts	4	4	8	2	6	....
Michigan	10	9	....	4	8	....
New Jersey	7	7	4	7	13	....
New York	9	10	1	3	1	1
Ohio	12	11	9	....	21	....
Pennsylvania	1	1	5	....	12	....
Virginia	3	3	15	14	7	....
Washington	6	5	11	6	14	....

Steam and other power vessels.—The construction of steam vessels now constitutes a large proportion of the shipbuilding operations of the United States. At the censuses prior to 1905 power vessels other than steam were included in the statistics for steam vessels, and therefore for purposes of comparison power vessels of 5 tons and over are combined with steam vessels in the statistics presented in Table 14. In Table 19 is shown the total value of steam and other power vessels launched, of iron and steel and of wooden construction, as reported at the last three censuses, with the per cent each class is of the total.

TABLE 19.—*Value of iron and steel and wooden steam and other power vessels of five tons and over launched by private shipyards, with per cent of total: 1890 to 1905.*

CLASS.	1905		1900		1890	
	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.
Total	$66,029,538	100.0	$27,305,701	100.0	$18,866,068	100.0
Iron and steel vessels	62,932,880	95.3	24,311,343	89.0	11,014,646	65.3
Wooden vessels	3,096,658	4.7	2,994,358	11.0	5,851,422	34.7

During the fifteen years covered by the table there has been more than a fourfold increase in the value of power driven steel vessels launched, whereas the value of power driven wooden vessels launched has decreased during the period, and as a result the value of the latter class of vessels formed an insignificant proportion of the total value at the census of 1905.

Table 20 shows, by states, the number, tonnage, and value of vessels of 5 tons or over driven by power other than steam, launched during 1904.

TABLE 20.—*Number, gross and net tonnage, and value of power vessels other than steam, of five tons and over, launched during 1904 by private shipyards, by states.*

STATE.	Number.	TONNAGE.		Value.
		Gross.	Net.	
United States	[1]311	3,247	2,383	$479,168
California	76	464	362	111,600
Massachusetts	13	110	90	22,628
Minnesota	13	485	263	29,044
Mississippi	5	72	49	10,400
New Jersey	6	41	34	5,550
New York	64	706	532	147,075
Virginia	26	190	146	19,075
Wisconsin	49	347	313	33,170
All other states[2]	59	832	594	100,626

[1] Includes 4 vessels of 90 gross tonnage and 50 net tonnage, valued at $5,750, which were launched by establishments engaged primarily in the manufacture o. other products.
[2] Includes states as follows: Alabama, Connecticut, Kentucky, Louisiana, Maine, Maryland, Michigan, New Hampshire, North Carolina, Ohio, Pennsylvania, Rhode Island, Texas, Washington.

The 311 vessels of 5 tons or over, with motive power other than steam, launched in the United States at the census of 1905, had an average gross tonnage of not quite 10½ tons and an average value of about $1,541. In the construction of these vessels New York led in tonnage and value, but California launched the greatest number.

The wide variation in the average value per gross ton of the vessels in the different states is due to the different character and uses to which such vessels are now applied. Pleasure boats, built for high speed and luxuriously fitted, have become a feature of motor boat building, while boats for fishing and freighting are also being constructed with internal combustion engines. The clumsy and unreliable engines of this type built by individual mechanics or small boat building concerns a few years ago have now given place to the reliable and compact motors built by large establishments devoted entirely to their construction. The evolution of the high speed motor boat has resulted naturally from the improvements in hydrocarbon engines, and the standardization of the parts of this class of motors has done much to increase the use of larger boats of this type.

Barges.—Table 21 gives the value of barges as reported at the last three censuses, divided according to iron and steel or wooden construction, with the per cent each is of the total at each census period.

TABLE 21.—*Value of iron and steel and wooden barges, with per cent of total: 1890 to 1905.*

CLASS.	1905		1900		1890	
	Value.	Per cent of total.	Value.	Per cent of total.	Value.	Per cent of total.
Total	$3,722,069	100.0	$4,009,170	100.0	$1,773,186	100.0
Iron and steel barges	528,180	14.2	181,000	4.5	325,000	18.3
Wooden barges	3,193,889	85.8	3,828,170	95.5	1,448,186	81.7

There was an increase in steel barge construction at the census of 1905 over both the previous censuses, but the per cent of the total remains comparatively small. Wooden barges still form the larger proportion of this product. The decrease shown for 1905 as compared with 1900 may be attributed to the depression in the shipbuilding industry rather than a decline in the use of barges.

Floating dry docks, floating coal docks, and such minor products as rafts and scows constructed for a single trip at the end of which they were broken up and sold as lumber, were not included in this presentation. There are, however, a considerable number of sand and mud scows, coal boats and lighters, dredges, pile drivers, house boats, etc., included in the statistics for 1900 and 1905. At the census of 1905 there were 577 of these craft, built chiefly in Pennsylvania, with a total tonnage of 55,596 and value of $303,357. The total value of these is comparatively small, but in number and tonnage they form a considerable part of the products of this class.

Table 22 shows, by states, the number, tonnage, and value of barges of all classes as reported at the last two censuses.

TABLE 22.—*Number, gross and net tonnage, and value of barges, by states: 1905 and 1900.*

STATE.	Census.	Number.	TONNAGE. Gross.	TONNAGE. Net.	Value.
United States	1905	[1]1,244	277,310	266,853	$3,722,069
	1900	844	299,560	255,537	4,009,170
California	1905	48	5,777	5,562	78,423
	1900	35	6,726	5,890	141,750
Florida	1905	43	2,065	2,063	14,650
	1900	26	1,888	1,708	41,751
Illinois	1905	9	2,251	2,211	19,900
	1900	2	60	52	250
Kentucky	1905	17	4,898	4,898	18,500
	1900	2	560	500	2,800
Louisiana	1905	72	11,538	10,097	141,048
	1900	20	3,210	2,686	56,425
Maryland	1905	48	19,899	18,870	383,565
	1900	29	12,027	10,911	169,820
Mississippi	1905	13	1,955	1,570	34,500
	1900	8	1,150	946	22,310
New Jersey	1905	35	19,605	19,481	379,841
	1900	41	42,987	37,778	386,606
New York	1905	185	79,094	75,618	941,666
	1900	175	65,602	51,196	1,008,664
Ohio	1905	41	3,434	3,245	114,025
	1900	36	9,640	8,610	120,000
Pennsylvania	1905	573	76,102	75,750	340,807
	1900	174	65,880	65,328	125,060
Virginia	1905	12	2,280	2,215	31,350
	1900	4	400	360	4,000
Washington	1905	34	4,437	3,816	92,740
	1900	116	2,478	2,183	75,916
All other states	[2]1905	114	43,975	41,457	1,131,054
	[3]1900	176	86,952	67,389	1,853,818

[1] Includes 124 barges of 21,770 gross tonnage and 21,690 net tonnage, valued at $323,468, built by establishments engaged primarily in the manufacture of other products.
[2] Includes states as follows: Alabama, Connecticut, Delaware, District of Columbia, Indiana, Iowa, Maine, Massachusetts, Minnesota, Missouri, New Hampshire, North Carolina, Oregon, Rhode Island, South Carolina, Texas, West Virginia, Wisconsin.
[3] Includes states as follows: Alabama, Arkansas, Connecticut, Delaware, District of Columbia, Georgia, Indiana, Iowa, Maine, Massachusetts, Michigan, Minnesota, Missouri, Oregon, Texas, West Virginia, Wisconsin.

The principal state in barge construction at the census of 1905 was New York, with Maryland second. Although Pennsylvania reported the greatest number of this kind of craft, the major proportion was scows, coal boats, etc. New Jersey, the third state in the building of barges for 1905, was second to New York for 1900.

Sail vessels.—The building of sail vessels of 5 tons and over is decreasing, as is evident from Tables 23 and 24. The first of these presents the statistics of sail vessels launched for the last three censuses according to iron and steel or wooden construction. with the per cent each is of the total.

TABLE 23.—*Value of iron and steel and wooden sail vessels of five tons and over launched by private shipyards, with per cent of total: 1890 to 1905.*

CLASS.	1905 Value.	1905 Per cent.	1900 Value.	1900 Per cent.	1890 Value.	1890 Per cent.
Total	$3,620,119	100.0	$4,210,228	100.0	$5,340,941	100.0
Iron and steel vessels	221,900	6.1	962,600	22.9	211,200	4.0
Wooden vessels	3,398,219	93.9	3,247,628	77.1	5,129,741	96.0

The above statistics show less steel vessel building for 1905 than for 1900. In the latter year one establishment on Lake Michigan built 3 steel sail vessels, aggregating 15,117 tons and valued at over $500,000, whereas the same establishment did not report any sail vessels launched in 1904. The value reported for wooden sail vessels of 5 tons and over launched during 1904 was slightly in advance of that for 1900, but considerably less than for 1890. The following table presents the number, tonnage, and value of sail vessels, by states, as reported at the last two censuses:

TABLE 24.—*Number, gross and net tonnage and value of sail vessels of five tons and over launched by private shipyards, by states: 1905 and 1900.*

STATE.	Census.	Number.	TONNAGE. Gross.	TONNAGE. Net.	Value.
United States	1905	349	64,615	55,074	$3,620,119
	1900	648	80,294	70,120	4,210,228
California	1905	16	1,116	1,021	65,277
	1900	22	8,256	7,530	560,860
Connecticut	1905	9	3,106	2,589	204,762
	1900	14	188	180	18,500
Maine	1905	77	38,692	32,461	2,050,783
	1900	76	32,651	28,100	1,500,301
Maryland	1905	4	384	268	29,000
	1900	20	374	220	20,450
Massachusetts	1905	49	4,280	2,994	297,875
	1900	128	3,889	2,910	384,000
Mississippi	1905	14	280	197	29,150
	1900	14	193	140	12,800
New Jersey	1905	26	880	761	86,800
	1900	80	357	240	25,695
New York	1905	34	5,146	4,924	287,900
	1900	85	1,400	1,150	139,697
North Carolina	1905	4	70	55	4,125
	1900	9	142	109	6,225
All other states	[1]1905	116	10,661	9,804	564,447
	[2]1900	200	32,844	29,541	1,541,700

[1] Includes states as follows: Alabama, Delaware, Florida, Illinois, Louisiana, Michigan, Missouri, Rhode Island, Virginia, Washington, Wisconsin.
[2] Includes states as follows: Alabama, Delaware, Florida, Georgia, Illinois, Kentucky, Louisiana, Michigan, Minnesota, Missouri, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, Texas, Virginia, Washington.

The state of Maine reported considerably more than one-half the total tonnage and value of sail vessels launched in the United States during 1904. A noteworthy increase is shown both in tonnage and value of sail vessels built in this state. Massachusetts, the second state in rank, shows an increased tonnage, but a decrease in value reported for sail vessels.

The falling off in the tonnage and value of the sail vessels included in "all other states" was caused by the decrease in the building of vessels of this type on the Great Lakes. As explained in the paragraph above in connection with Table 23, one establishment on Lake Michigan accounted for about one-half of the decrease.

Canal boats.—Canal boat building has fallen off materially, as is shown in Table 14. The decrease since 1880 in both the number and value of canal boats built is there seen to have been over 50 per cent at each census period. All of the canal boats reported during 1904 were constructed of wood, although 6 steel canal

boats were built in the year following. In Table 25 the number, tonnage, and value of canal boats built are given by states as reported in 1900 and 1905.

TABLE 25.—*Number, gross and net tonnage, and value of canal boats, by states: 1905 and 1900.*

STATE.	Census.	Number.	TONNAGE.		Value.
			Gross.	Net.	
United States	1905	30	5,613	5,408	$99,300
	1900	70	20,994	19,509	225,374
New York	1905	26	5,217	5,076	83,100
	1900	32	6,909	5,499	82,850
All other states	[1] 1905	4	396	332	16,200
	[2] 1900	38	14,085	14,010	142,524

[1] Includes states as follows: Louisiana, Maryland.
[2] Includes states as follows: Connecticut, Illinois, Maryland, New Jersey, Ohio, Pennsylvania.

Inasmuch as there were but 4 small canal boats reported by other states during the census year, New York is the only state that can be separately reported for the census of 1905. In addition to these, a few may have been built by boat builders or by canal transportation companies.

The canal boat is built to carry the greatest possible cargo with a minimum draft. Although intended primarily for use on canals, some of them appear on rivers and lakes, as in the case of the canal boats of the Erie canal, which often receive their cargo at New York city, and are towed up the Hudson river, through the canal to their destination, which may be Buffalo or some other lake port.

Small boats.—Included under this head are all vessels of less than 5 gross tons built by establishments reporting a product of $500 or over during the census year. All classes of small power and sailboats, rowboats, and canoes are represented in the statistics given; but, as this class of construction is often done by carpenters or other individuals who are not regularly engaged in the work, it is probable that there was actually a considerably greater aggregate than is shown. However, as may be deduced from Table 4, there was an increase of 52.4 per cent in the value reported for 1905 over that shown for 1900, an increase of 41.4 per cent from 1890 to 1900, and an increase of 58.7 per cent from 1880 to 1890, which shows the steady advance in this manufacture. Table 26 shows for 1900 and 1905, by states, the number and value of small boats manufactured, under two heads, namely, "small power boats" and "rowboats, canoes, and small sailboats."

The difference between the total value as reported in Table 26 for 1905 and the amount shown in Table 4, $147,542, represents the value of small boats reported by establishments engaged primarily in the manufacture of other products. An increase is shown in 1905, as compared with 1900, in the manufacture of small power boats and in the aggregate reported for rowboats, canoes, and small sailboats, both as to total number and total value.

TABLE 26.—*Number and value of boats under five tons, by states: 1905 and 1900.*

STATE.	Census.	Total value.	SMALL POWER BOATS.		ROWBOATS, CANOES, AND SMALL SAILBOATS.	
			Number.	Value.	Number.	Value.
United States	1905	$3,148,834	[1] 3,771	$1,981,815	[2] 23,248	$1,167,019
	1900	1,968,835	1,687	1,059,305	13,739	909,470
California	1905	132,967	83	56 980	500	75,987
	1900	100,015	14	9,800	583	90,215
Connecticut	1905	126,579	156	74 935	324	51,644
	1900	72,107	159	56,855	159	15,252
Florida	1905	26,905	45	23,893	72	3,012
	1900	20,671	1	1,000	96	19,671
Illinois	1905	54,875	116	40,570	442	14,305
	1900	20,898	5	5,950	356	14,948
Iowa	1905	73,598	139	67,730	109	5,868
	1900	4,249	2	1,404	38	2,845
Louisiana	1905	8,338	23	7,375	24	963
	1900	1,935	......	....	38	1,935
Maine	1905	228,050	289	88,094	3,976	139,956
	1900	93,571	8	5,895	1,892	87,676
Maryland	1905	44,170	39	32,030	144	12,140
	1900	31,364	15	11,500	237	19,864
Massachusetts	1905	383,814	342	181,380	3,817	202,434
	1900	208,964	41	49,383	3,760	159,581
Michigan	1905	414,583	771	268,449	4,447	146,134
	1900	241,010	327	171,405	669	69,605
Minnesota	1905	172,493	308	103,940	1,604	68,553
	1900	33,975	37	17,485	488	16,490
New Hampshire	1905	8,698	20	8,200	13	498
	1900	2,943	......	....	63	2,943
New Jersey	1905	279,947	237	220,558	499	59,389
	1900	69,777	82	48,857	219	20,920
New York	1905	629,658	544	433,606	2,302	196,052
	1900	654,702	552	454,643	2,093	200,059
Ohio	1905	111,655	214	100,400	382	11,255
	1900	47,205	78	34,400	292	12,805
Pennsylvania	1905	49,928	39	22,835	544	27,093
	1900	47,036	15	11,000	380	36,036
Rhode Island	1905	39,365	15	20,740	192	18,625
	1900	21,904	2	3,000	131	18,904
Virginia	1905	48,966	77	43,039	191	5,927
	1900	10,387	1	4,000	76	6,387
Washington	1905	48,535	30	17,770	658	30,765
	1900	61,289	10	26,900	384	34,389
Wisconsin	1905	105,897	137	66,097	1,163	39,800
	1900	117,801	241	89,780	639	28,021
All other states	[3] 1905	159,813	147	103,194	1,745	56,619
	[4] 1900	107,032	97	56,108	1,146	50,924

[1] Includes 272 boats, valued at $102,527, made by establishments engaged primarily in the manufacture of other products.
[2] Includes 474 boats, valued at $45,015, made by establishments engaged primarily in the manufacture of other products.
[3] Includes states as follows: Alabama, Delaware, District of Columbia, Georgia, Idaho, Indiana, Kentucky, Mississippi, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas.
[4] Includes states as follows: Arkansas, Delaware, District of Columbia, Idaho, Indiana, Kentucky, Mississippi, Missouri, North Carolina, Oregon, Tennessee, Texas, Vermont.

New York was the leading state in this construction at both censuses, reporting about one-fifth of the total value of small boats in 1905 and about one-third in 1900. A slight decrease is seen to have taken place during the five-year period in the value reported for both classes of small boats constructed in this state. Michigan and Massachusetts, the second and third

states, respectively, in small boat building, as reported for both 1905 and 1900, show a considerable increase for the intervening period. Maine, Minnesota, New Jersey, California, Connecticut, and Ohio rank from fourth to ninth, in the order named, all outranking Wisconsin, which has dropped from fourth place in 1900 to tenth in 1905.

Repair work.—The statistics concerning the value of repair work done by shipbuilding establishments show that such work is a prominent feature in the industry. As may be seen from Table 4, 27.6 per cent of the total value of products reported by the private shipyards of the United States during 1904 was for repairs. Table 27 gives the value of repair operations reported by iron and steel and wooden shipbuilding plants, including Government establishments, at the censuses of 1900 and 1905, with the per cent the repairs done in each kind of establishment were of the total and the per cent of increase during the five-year period.

TABLE 27.—*Value of repair work reported by private and Government shipyards, with per cent of total and per cent of increase: 1905 and 1900.*

	1905		1900		Per cent of increase.
	Value.	Per cent of total.	Value.	Per cent of total.	
Total	$32,466,751	100.0	$29,604,674	100.0	9.7
Private shipyards:					
Iron and steel	12,191,854	37.5	12,302,960	41.6	[1] 0.9
Wooden	10,637,186	32.8	10,831,476	36.6	[1] 1.8
Government shipyards	9,637,711	29.7	6,470,238	21.8	49.0

[1] Decrease.

The value of repairs reported by private shipyards decreased somewhat in the five years intervening between the two censuses, but the value of repairs reported by Government establishments is seen to have increased materially during the same period. These conditions indicate that an increasingly large proportion of repairs on naval vessels, which is now a considerable item in the aggregate value of repair work, is done in Government yards. Taken together, the amount of repairs reported by private shipyards and Government establishments shows an increase of $2,862,077 during the period. In Table 28 the value of repair operations by private shipyards is shown by states, as reported at the last three censuses.

New York was the leading state in this class of work at the three censuses shown in Table 28, and in 1905 reported nearly three times the value shown for New Jersey, the second state in rank at this census. New York shows an increase of 38.5 per cent from 1900 to 1905, while New Jersey reports an increase of but 1.1 per cent during the same period. California, the third state in rank in this class of work, shows a decrease of 7.1 per cent in 1905 as compared with 1900. Pennsylvania was second in 1900, but on account of a decrease of 35.1 per cent was passed in 1905 by both New Jersey and California, and occupied fourth place at the latter census. Ohio, Virginia, and Maryland were respectively fifth, sixth, and seventh in rank in the value of repairs reported at the census of 1905.

TABLE 28.—*Value of repair work reported by private shipyards, by states: 1890 to 1905.*

STATE.	1905	1900	1890[1]
United States	$22,829,040	$23,134,436	$10,513,237
California	2,180,542	2,348,017	434,791
Connecticut	356,032	310,616	239,952
Delaware	454,780	386,841	328,132
Florida	116,360	208,984	39,610
Illinois	439,509	484,541	273,498
Iowa	31,075	23,366	46,569
Maine	297,855	642,195	133,181
Maryland	1,010,622	1,138,420	557,198
Massachusetts	854,036	1,603,716	653,959
Michigan	688,482	1,027,923	519,092
Minnesota	55,900	78,597	34,895
Mississippi	125,951	42,417	17,230
New Jersey	2,254,794	2,229,481	1,315,546
New York	6,726,959	4,857,916	3,642,505
North Carolina	63,300	65,935	55,227
Ohio	1,229,123	1,241,122	323,965
Oregon	184,276	382,662	35,060
Pennsylvania	1,762,243	2,716,209	329,806
Rhode Island	660,303	874,065	86,727
Virginia	1,157,595	752,971	351,220
Washington	712,851	534,759	14,825
West Virginia	86,595	45,670	20,060
Wisconsin	571,746	531,792	189,677
All other states[2]	808,111	606,221	870,512

[1] Includes $500,848 reported by governmental establishments not reported separately by states.

[2] Includes states as follows: 1905—Alabama, District of Columbia, Georgia, Idaho, Indiana, Kentucky, Louisiana, Missouri, New Hampshire, South Carolina, Tennessee, Texas. 1900—Alabama, Arkansas, District of Columbia, Idaho, Indiana, Kentucky, Louisiana, Missouri, New Hampshire, South Carolina, Tennessee, Texas, Vermont, West Virginia. 1890—Alabama, Arkansas, District of Columbia, Georgia, Indiana, Kentucky, Louisiana, Missouri, New Hampshire, South Carolina, Tennessee, Texas.

EQUIPMENT OF SHIPYARDS.

Intimately connected with the repair work of a shipyard is the dry dock and marine railway equipment. Table 29 shows, by states, for 1905 the number of establishments thus equipped in comparison with the total number for continental United States, and the value of repair operations in establishments having dry dock or marine railway equipment in comparison with the total for repair work in each state.

The 388 private yards in the United States which have dry dock or marine railway equipment form only 35.4 per cent of the total number of shipbuilding and repair establishments, but they are credited with 77.3 per cent of the total value of ship repairs reported by all establishments. New York, the leading state in ship repair operations, shows the largest number of establishments having dry dock or marine railway equipment. Establishments having these facilities, therefore, do the bulk of the repair work.

TABLE 29.—*Number of private shipyards and value of repair work, together with number of private shipyards reporting dry dock or marine railway equipment and value of their repair work: 1905.*

STATE.	PRIVATE SHIPYARDS. Total number.	PRIVATE SHIPYARDS. Number reporting dry dock or marine railway.	VALUE OF REPAIR WORK. Total.	VALUE OF REPAIR WORK. Reported by establishments equipped with dry dock or marine railway.
United States	1,097	388	$22,829,040	$17,635,653
California	41	13	2,180,542	1,880,392
Connecticut	46	21	356,032	220,305
Delaware	10	5	454,780	449,143
Florida	14	11	116,360	112,360
Illinois	22	6	439,509	384,986
Iowa	9	3	31,075	11,080
Maine	139	16	297,855	226,629
Maryland	35	25	1,010,622	733,781
Massachusetts	125	25	854,036	473,068
Michigan	57	11	688,482	588,238
Minnesota	28	8	55,900	37,512
Mississippi	13	7	125,951	121,600
New Jersey	78	29	2,254,794	1,443,693
New York	210	100	6,726,959	5,253,451
North Carolina	12	4	63,300	43,200
Ohio	22	8	1,229,123	1,151,840
Oregon	11	4	184,276	65,390
Pennsylvania	33	12	1,762,243	1,402,747
Rhode Island	16	14	660,303	133,519
Virginia	24	15	1,157,595	1,074,588
Washington	40	10	712,851	630,181
West Virginia	3	3	86,595	86,595
Wisconsin	33	4	571,746	437,215
All other states [1]	76	34	808,111	674,140

[1] Includes establishments distributed as follows: Alabama, 7; District of Columbia, 3; Georgia, 2; Idaho, 3; Indiana, 10; Kentucky, 9; Louisiana, 20; Missouri, 6; New Hampshire, 5; South Carolina, 1; Tennessee, 2; Texas, 8.

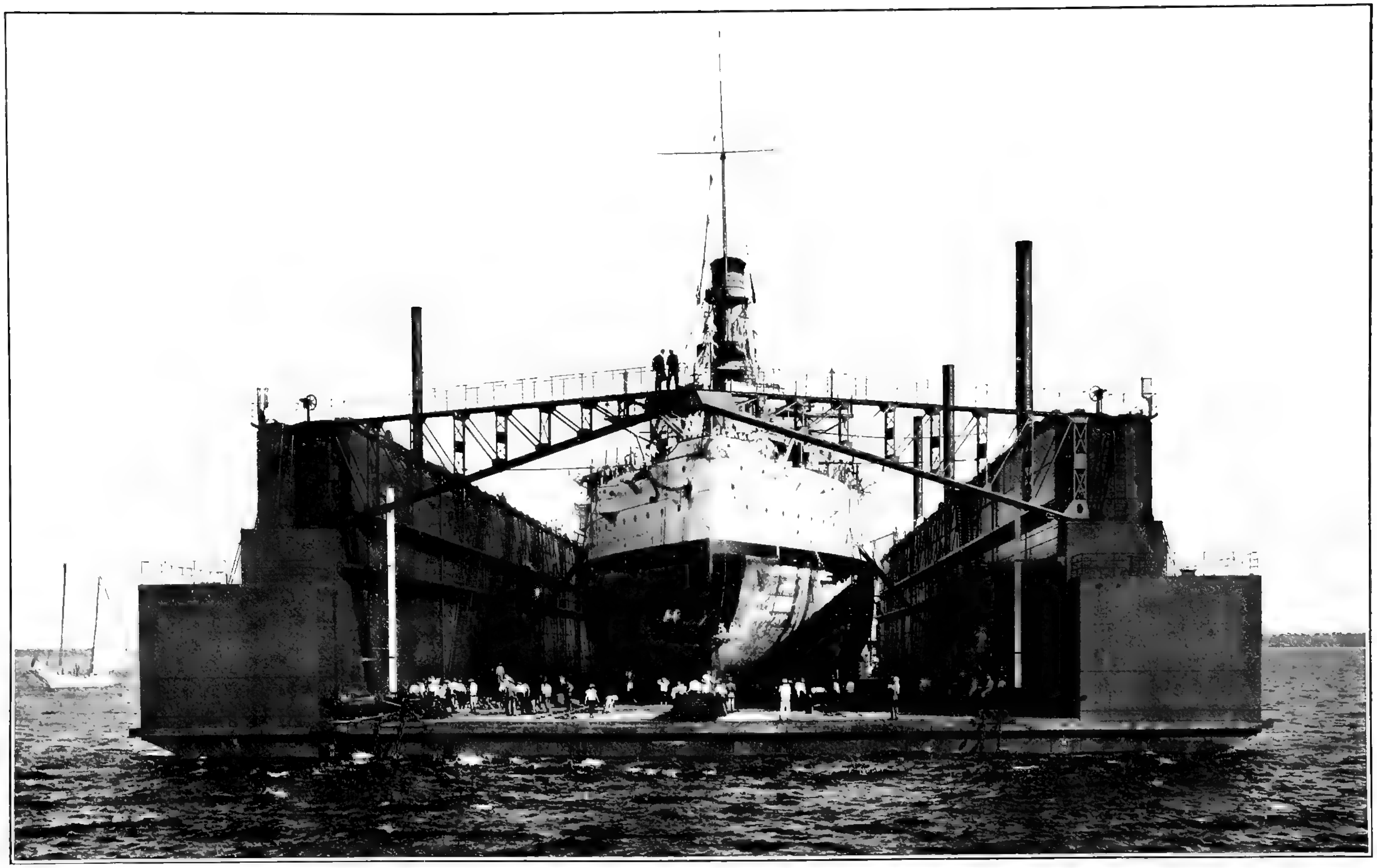
Dry docks.—In Table 30 is shown the number of dry docks, both private and Government, classified according to kind and dimensions—length of floor, width at entrance, and depth on sill—by states and geographic divisions.

As shown in Table 30, about two-thirds of the dry docks of the United States are in the North Atlantic states, New York alone reporting over one-third of the total number. Of the 62 dry docks reported in New York state, 57 are over 100 feet long in floor measurement, and 14 of these measure over 300 feet; 26 measure over 50 feet in width at entrance, 7 of these over 75 feet in width and over 20 feet in depth of sill, dimensions sufficient to accommodate the largest vessels.

New Jersey, the second state in importance with respect to dry dock equipment, shows as many dry docks as the entire North Central division. All of the 23 are over 100 feet in floor length, and 2 of them measure over 300 feet. Twelve of the dry docks in this state have a width at entrance of over 50 feet, and 20 have a depth on the sill of more than 10 feet. The remaining states in the North Atlantic group report 17 dry docks, 13 of which are over 100 feet in floor length and 5 are over 20 feet in depth of sill, while only 2 have a width at entrance exceeding 75 feet.

TABLE 30.—NUMBER AND KIND OF DRY DOCKS IN PRIVATE AND GOVERNMENT SHIPYARDS, CLASSIFIED ACCORDING TO DIMENSIONS, BY STATES AND GEOGRAPHIC DIVISIONS: 1905.

STATE.	NUMBER OF DRY DOCKS. Total.	Stationary.	Floating.	With floor length of— Over 300 feet.	201 to 300 feet.	101 to 200 feet.	100 feet or less.	With entrance width of— Over 75 feet.	51 to 75 feet.	26 to 50 feet.	25 feet or less.	With sill depth of— Over 20 feet.	10 to 20 feet.	Less than 10 feet.
United States	160	74	86	53	18	75	14	22	53	62	23	25	101	34
North Atlantic division	102	41	61	25	12	56	9	10	35	40	17	13	65	24
Maine	3	2	1	2		1		1	1	1		2	1	
Massachusetts	5	5		3	1	1		1	2	2		2	3	
Rhode Island	1		1			1			1				1	
New York	62	27	35	14	6	37	5	7	19	22	14	7	39	16
New Jersey	23	3	20	2	5	16		1	11	11		1	19	3
Pennsylvania	8	4	4	4			4		1	4	3	1	2	5
South Atlantic division	18	8	10	8	2	8		5	6	5	2	7	7	4
Delaware	1	1		1					1				1	
Maryland	6	2	4	2	1	3		1	3	1	1	2	4	
Virginia	4	4		4				3	1			4		
West Virginia	3		3		1	2				3				3
Florida	4	1	3	1		3		1	1	1	1	1	2	1
North Central division	23	17	6	14	1	6	2	2	9	12			23	
Ohio	6	6		6					3	3			6	
Illinois	4	4		2	1	1			2	2			4	
Michigan	2	2		2				1	1				2	
Wisconsin	9	4	5	4		4	1		2	7			9	
Minnesota	1		1				1		1				1	
Missouri	1	1				1		1					1	
South Central division	10	3	7	2	3	3	2	1	2	4	3	1	4	5
Kentucky	1		1		1					1				1
Alabama	2		2	1	1				1	1			2	
Mississippi	1	1				1					1		1	
Louisiana	5	1	4	1	1	1	2	1	1	2	1	1		4
Texas	1	1				1					1		1	
Western division	7	5	2	4		2	1	4	1	1	1	4	2	1
Washington	5	3	2	2		2	1	2	1	1	1	3	1	1
California	2	2		2				2				1	1	



FLOATING DRY DOCK, DEWEY.

Of the 18 dry docks reported in the South Atlantic division, 8 were stationary; 4 of these, all in the state of Virginia, had a length of floor of over 300 feet, a width at entrance of more than 50 feet, and a depth on the sill of over 20 feet. Maryland has 2 large stationary dry docks, Delaware 1, and Florida 1. Four of the floating dry docks in the South Atlantic division were in Maryland, 3 in West Virginia, and 3 in Florida.

Of the 23 docks reported in the North Central division, only 2 have a width at entrance of more than 75 feet, and none exceed 20 feet in depth of sill, but 14 are over 300 feet in length of floor. Wisconsin has 4 stationary and 5 floating docks, but Ohio reports 6 large stationary dry docks, all of which are over 300 feet in length of floor. Illinois and Michigan each have 2 stationary dry docks with a floor length of over 300 feet.

The Western division has 4 dry docks with floor length of over 300 feet, a width at entrance of over 75 feet, and a depth on the sill of over 20 feet. Two of these are in Washington and 2 in California. The South Central division has 2 floating dry docks of more than 300 feet of floor length, 1 of which is in Alabama and the other in Louisiana.

The statistics presented in Table 30 are for the year 1904 and include 15 Government dry docks reported by the naval stations, shown in the following tabular statement:

Number and kind of dry docks at each naval station in the United States: 1905.

NAVAL STATION.	Stationary.	Floating.
Total	11	4
Mare Island	1	
Pensacola		2
Portsmouth	1	1
Boston	2	
Brooklyn	3	
League Island	1	
Norfolk	2	
Puget Sound	1	
New Orleans		1

In addition to the dry docks included in the above statement, graving docks were under construction during 1904 at the naval stations at League Island, Pa.; Norfolk, Va.; Charleston, S. C.; and Mare Island, California.

The building of a floating dry dock is an extensive piece of work, and, while this work is not designated as vessel construction, its value for 1905 appears in this report under the head of "all other products." The most important construction of this kind during 1903 and 1904 was the building of the self-docking steel floating dry dock *Dewey* for the naval station in the Philippine Islands.

The *Dewey* is capable of lifting about 20,000 tons, which is considerably more than the weight of any vessel now in the United States Navy. The difficult feat of towing this enormous dry dock 14,000 miles from the shipyard to Subig bay, Philippine Islands, has been safely accomplished since the compilation of these statistics, and it may now be added to the list of available docks of the United States Government.

Marine railways.—Table 31 presents the number and total lifting capacity of the marine railways of the United States, by states and geographic divisions, and also the number of railways, classified by dimensions and lifting capacity. There was 1 Government marine railway at the Norfolk navy yard which is included in the table. There were also 5 Government railways, 1 of which was situated at Washington, D. C., 1 at San Juan, Porto Rico, and 3 at Cavite, Philippine Islands, which are not included in this list, as these stations were not reported as being engaged in ship construction and repairs.

Table 31 shows that more than one-half the total number of marine railways of the United States are located in the North Atlantic states. New York alone reported about one-fourth of the total number. Of the New York marine railways, 31 have a cradle length exceeding 100 feet, 33 a cradle breadth exceeding 25 feet, and 11 have a lifting capacity exceeding 500 tons. New Jersey is the second state in rank of the North Atlantic states according to the total lifting capacity represented by marine railways, although Connecticut and Massachusetts both report a greater number. Of the 24 marine railways reported in New Jersey, 12 have a cradle length of more than 100 feet and 10 have a cradle breadth exceeding 25 feet, while 5 have a lifting capacity of 500 tons. Eight of the marine railways reported in Connecticut have a cradle length of more than 100 feet, 9 a cradle breadth exceeding 25 feet, and 7 a lifting capacity of 500 tons or over.

Following the 3 states above mentioned, in the order of their importance among the North Atlantic states in tons of lifting capacity represented in marine railway equipment, are Maine, Massachusetts, Pennsylvania, and Rhode Island. In these states there are 6 railways with cradles more than 200 feet in length, 36 railways with cradles exceeding 25 feet in breadth, and 16 railways with a lifting capacity of 500 tons and over.

Table 31.—NUMBER AND LIFTING CAPACITY OF MARINE RAILWAYS, CLASSIFIED ACCORDING TO DIMENSIONS AND LIFTING CAPACITY, BY STATES AND GEOGRAPHIC DIVISIONS: 1905.

STATE.	Total number.	Total lifting capacity (tons).	NUMBER OF MARINE RAILWAYS. With cradle length of— Over 200 feet.	With cradle length of— 101 to 200 feet.	With cradle length of— 50 to 100 feet.	With cradle length of— Less than 50 feet.	With cradle breadth of— Over 50 feet.	With cradle breadth of— 25 to 50 feet.	With cradle breadth of— Less than 25 feet.	With cradle draft submerged— Forward. Over 10 feet.	Forward. 5 to 10 feet.	Forward. Less than 5 feet.	Aft. Over 15 feet.	Aft. 11 to 15 feet.	Aft. 5 to 10 feet.	Aft. Less than 5 feet.	With lifting capacity of— Over 1,000 tons.	501 to 1,000 tons.	100 to 500 tons.	Less than 100 tons.
United States	413	147,047	44	133	107	129	16	140	257	35	234	144	51	99	221	42	34	54	141	184
North Atlantic division	216	71,901	19	62	55	80	9	79	128	22	124	70	22	48	121	25	18	21	68	109
Maine	19	9,610	1	13	3	2	....	15	4	3	15	1	3	8	8	....	2	5	8	4
Massachusetts	28	7,055	1	7	3	17	2	8	18	4	19	5	4	8	11	5	1	3	8	16
Rhode Island	17	2,137	....	2	7	8	....	5	12	1	13	3	1	3	11	2	....	....	7	10
Connecticut	26	10,358	2	6	6	12	1	8	17	4	13	9	3	5	17	1	3	4	4	15
New York	93	25,516	7	24	30	32	2	31	60	6	46	41	9	16	55	13	7	4	31	51
New Jersey	24	12,680	4	8	4	8	4	6	14	4	10	10	2	5	14	3	4	1	8	11
Pennsylvania	9	4,545	4	2	2	1	....	6	3	....	8	1	....	3	5	1	1	4	2	2
South Atlantic division	80	29,678	13	31	18	18	1	31	48	3	37	40	10	26	36	8	6	17	29	28
Delaware	5	2,035	....	3	1	1	....	2	3	....	3	2	1	1	2	1	....	2	2	1
Maryland	30	10,470	4	16	8	2	....	14	16	2	14	14	3	13	13	1	2	5	14	9
District of Columbia	2	115	....	....	2	....	....	....	2	....	....	2	....	....	2	....	....	....	....	2
Virginia	25	10,114	6	6	5	8	....	9	16	....	12	13	4	5	12	4	3	4	9	9
North Carolina	5	2,700	2	2	1	....	....	2	3	....	3	2	2	2	1	....	....	3	2	....
South Carolina	1	1,000	....	1	....	....	1	....	....	....	1	....	....	1	....	....	....	1	....	....
Florida	12	3,244	1	3	1	7	....	4	8	1	4	7	....	4	6	2	1	2	2	7
North Central division	41	8,839	3	4	11	23	1	7	33	1	26	14	1	11	23	6	3	1	6	31
Ohio	4	2,975	....	2	1	1	....	1	3	....	2	2	....	....	4	....	1	1	1	1
Indiana	1	1,500	1	....	....	....	1	....	....	....	1	....	....	....	1	....	1	....	....	....
Illinois	4	2,770	2	....	....	2	....	2	2	....	3	1	....	....	2	2	1	....	2	1
Michigan	9	572	....	1	2	6	....	1	8	1	5	3	1	1	6	1	....	....	1	8
Wisconsin	1	100	....	1	....	....	....	1	....	....	1	....	....	....	1	....	....	....	1	....
Minnesota	11	202	....	....	....	11	....	....	11	....	4	7	....	....	9	2	....	....	1	10
Iowa	3	120	....	....	....	3	....	....	3	....	2	1	....	2	....	1	....	....	....	3
Missouri	8	600	....	....	8	....	....	2	6	....	8	....	....	8	....	....	....	....	....	8
South Central division	33	11,150	4	16	12	1	1	4	28	4	15	14	5	10	18	....	3	1	22	7
Kentucky	1	1,500	1	....	....	....	....	1	....	....	1	....	....	1	....	....	1	....	....	....
Alabama	5	2,240	1	2	2	....	1	3	1	1	2	2	1	1	3	....	1	....	3	1
Mississippi	7	1,825	1	6	....	....	....	....	7	2	5	....	1	4	2	....	....	....	7	....
Louisiana	19	5,510	1	8	9	1	....	....	19	1	7	11	3	4	12	....	1	1	12	5
Texas	1	75	....	....	1	....	....	....	1	....	....	1	....	....	1	....	....	....	....	1
Western division	43	25,479	5	20	11	7	4	19	20	5	32	6	13	4	23	3	4	14	16	9
Idaho	1	200	....	....	1	....	....	1	....	....	1	....	....	....	1	....	....	....	1	....
Washington	8	6,452	1	3	2	2	2	2	4	2	3	3	2	2	4	....	2	....	3	3
Oregon	7	1,825	1	4	1	1	....	5	2	1	5	1	....	1	6	....	....	1	5	1
California	27	17,002	3	13	7	4	2	11	14	2	23	2	11	1	12	3	2	13	7	5

POWER.

The statistics regarding power used by private iron and steel and wooden shipbuilding establishments reported at the last two censuses are presented in Table 32.

TABLE 32.—*Number of private establishments reporting power owned or rented, and amount of each kind of power available for use, by branches: 1905 and 1900.*

	TOTAL.		IRON AND STEEL.		WOODEN.	
	1905	1900	1905	1900	1905	1900
Number of establishments reporting	611	423	54	43	557	380
Total horsepower	93,390	67,949	66,186	44,096	27,204	23,853
Owned—						
Engines—						
Steam—						
Number	1,015	802	439	308	576	494
Horsepower	69,253	55,849	45,142	35,902	24,111	19,947
Gas and gasoline—						
Number	182	48	7	3	175	45
Horsepower	1,785	645	88	28	1,697	617
Water wheels—						
Number	4	10	....	....	4	10
Horsepower	67	1,700	....	....	67	1,700
Water motors—						
Number	5	....	2	....	3	....
Horsepower	20	....	3	....	17	....
Electric motors—						
Number	1,137	428	1,121	395	16	33
Horsepower	15,263	6,202	15,157	5,234	106	968
Other power, horsepower	4,404	2,275	4,103	2,220	301	55
Rented—						
Electric—						
Number	153	....	100	....	53	....
Horsepower	2,367	975	1,563	692	804	283
Other kind, horsepower	231	303	130	20	101	283
Furnished to other establishments, horsepower	170	127	145	....	25	127

Of the total number of shipbuilding establishments in the United States, 55.7 per cent reported the use of power in 1905 as compared with 38.2 per cent in 1900. All the iron and steel shipbuilding establishments and over one-half the wooden shipbuilding establishments reported power used, at the census of 1905. There was an absolute increase of 25,441 horsepower over the amount reported in 1900, which represents an increase of 50.1 per cent reported by iron and steel shipbuilding and repair plants, and of 14 per cent reported by wooden shipbuilding and repair establishments. There were 486 wooden shipbuilding and repair yards which were without power.

Of the total horsepower shown for the census of 1905 in Table 32, 74.2 per cent represents steam engines owned, an increase of 26.6 per cent in number and 24 per cent in horsepower over 1900. The use of gas engines is reported to have increased materially, while fewer water wheels are used. Electricity was reported to a much greater extent for 1905, as is shown in the increased number of electric motors reported, and by the heavy increase of 146.1 per cent in the electric horsepower reported. In fact, electricity has become essential to the equipment of a modern shipbuilding plant.

The detailed statistics of the shipbuilding industries are shown, by states, for 1905 in Tables 33 and 34. Table 33 is a summary of statistics for iron and steel shipbuilding, and Table 34 is a summary for wooden shipbuilding.

TABLE 33.—IRON AND STEEL SHIPBUILDING—DETAILED SUMMARY, BY STATES: 1905.

	United States.	Connecticut.	Maryland.	Michigan.	New Jersey.	New York.	Pennsylvania.	All other states.[1]
Number of establishments	54	4	3	5	6	10	5	21
Capital, total	$101,528,251	$704,500	$3,068,366	$3,126,832	$8,006,760	$6,988,521	$17,436,760	$62,196,512
Land	$17,955,229	$16,500	$238,400	$630,115	$1,139,500	$1,842,588	$7,248,000	$6,840,126
Buildings	$19,592,761	$71,000	$432,926	$753,774	$2,981,341	$865,576	$1,979,650	$12,508,494
Machinery, tools, and implements	$21,985,832	$274,000	$1,630,284	$888,621	$2,295,983	$1,852,337	$3,659,772	$11,384,835
Cash and sundries	$41,994,429	$343,000	$766,756	$854,322	$1,589,936	$2,428,020	$4,549,338	$31,463,057
Proprietors and firm members	18	4			6	5		3
Salaried officials, clerks, etc.:								
Total number	1,770	46	98	102	262	164	297	801
Total salaries	$2,544,297	$73,600	$118,462	$99,402	$406,548	$274,071	$450,106	$1,122,108
Officers of corporations—								
Number	96	3	4	7	9	13	15	45
Salaries	$567,045	$20,000	$8,108	$26,300	$67,056	$74,425	$128,167	$242,989
General superintendents, managers, clerks, etc.—								
Total number	1,674	43	94	95	253	151	282	756
Total salaries	$1,977,252	$53,600	$110,354	$73,102	$339,492	$199,646	$321,939	$879,119
Men—								
Number	1,592	41	94	81	252	150	282	692
Salaries	$1,920,797	$52,000	$110,354	$71,403	$338,742	$199,135	$321,939	$827,224
Women—								
Number	82	2		14	1	1		64
Salaries	$56,455	$1,600		$1,699	$750	$511		$51,895
Wage-earners, including pieceworkers, and total wages:								
Greatest number employed at any one time during the year	48,303	1,664	2,306	2,972	3,685	6,506	7,279	23,891
Least number employed at any one time during the year	26,117	824	988	554	2,824	1,879	4,961	14,087
Average number	36,742	1,263	2,050	1,346	3,279	3,397	6,098	19,309
Total wages	$20,809,908	$655,000	$1,015,653	$770,953	$1,990,543	$2,384,565	$3,187,699	$10,805,495
Men 16 years and over—								
Average number	35,941	1,263	2,031	1,322	3,279	3,395	5,727	18,924
Wages	$20,647,475	$655,000	$1,010,219	$766,561	$1,990,543	$2,383,760	$3,101,223	$10,740,169
Women 16 years and over—								
Average number	44					2	5	37
Wages	$21,552					$805	$2,006	$18,741
Children under 16 years—								
Average number	757		19	24			366	348
Wages	$140,881		$5,434	$4,392			$84,470	$46,585
Average number of wage-earners, including pieceworkers, employed during each month:[2]								
Men 16 years and over—								
January	35,793	1,548	2,265	908	3,550	3,562	5,333	18,627
February	35,443	1,530	2,106	979	3,469	2,989	5,599	18,771
March	35,928	1,493	2,192	1,006	3,366	2,965	5,896	19,010
April	37,455	1,428	1,993	940	3,324	4,868	5,993	18,909
May	36,264	1,441	1,856	642	3,307	4,750	6,057	18,211
June	36,033	1,418	2,024	413	3,113	4,610	6,011	18,444
July	35,491	1,302	2,050	2,483	3,061	2,981	5,656	17,958
August	35,508	1,177	2,094	1,684	2,991	2,930	5,760	18,872
September	35,674	1,016	2,018	2,060	3,325	2,678	5,686	18,891
October	35,903	952	1,994	2,008	3,340	2,757	5,770	19,082
November	35,862	971	1,940	1,796	3,249	2,862	5,545	19,499
December	35,938	880	1,840	945	3,253	2,788	5,418	20,814
Miscellaneous expenses, total	$3,767,620	$61,575	$179,041	$207,450	$170,698	$645,271	$857,721	$1,645,864
Rent of works	$111,695	$7,000		$7,300	$7,950	$31,900	$46,200	$11,345
Taxes	$229,874	$1,300	$7,368	$23,344	$8,138	$47,207	$32,184	$110,333
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$3,144,279	$40,075	$171,673	$59,722	$119,997	$566,164	$779,337	$1,407,311
Contract work	$281,772	$13,200		$117,084	$34,613			$116,875
Materials used, total cost	$27,601,824	$2,164,695	$1,361,416	$684,099	$2,587,626	$2,088,158	$4,856,021	$13,859,809
Pig and scrap iron	$191,573	$2,000		$24,569	$5,000	$7,769	$20,605	$131,630
Iron and steel, plates, beams, angles, forgings, rivets, bolts and spikes, castings, etc	$12,451,583	$639,100	$663,972	$398,704	$1,880,492	$688,768	$2,079,901	$6,100,646
Yellow metal, including bolts and spikes	$377,666	$525	$198	$33,408	$100,586	$36,022	$109,631	$97,296
Copper, sheets and pipes	$758,282	$38,000	$27,420	$1,130	$24,445	$24,655	$427,821	$214,811
Lumber, all kinds (including logs, timber, and knees)	$1,815,470	$118,200	$94,720	$35,373	$147,670	$249,811	$264,993	$904,703
Cordage—								
Wire	$80,026	$5,500	$975	$5,060	$3,496	$21,717	$19,884	$23,394
Manila and hemp	$112,129	$10,100	$1,320	$5,230	$19,654	$17,727	$10,574	$47,524
Oakum and pitch	$37,668	$1,000	$370	$542	$1,850	$15,326	$4,251	$14,329
Machinery and boilers, purchased	$3,636,068	$465,000	$118,186	$73,450	$141,089	$97,126	$673,786	$2,067,431
Anchors and chains, purchased	$110,217	$15,000	$2,553	$15,824	$3,165	$16,371	$21,121	$36,183
Masts and spars, purchased	$33,241	$3,000	$2,462	$700	$1,044	$18,578	$4,827	$2,630
Blocks, purchased	$27,565	$6,500	$1,355	$875	$3,930	$7,771	$2,581	$4,553
Fuel	$965,548	$51,930	$71,031	$39,850	$108,549	$88,758	$142,131	$463,299
Rent of power and heat	$29,813			$2,400	$2,817	$6,187		$18,409
Mill supplies	$237,474	$7,725	$26,260	$5,919	$17,287	$13,566	$11,955	$154,762
All other materials	$6,611,295	$800,615	$350,594	$29,215	$126,047	$755,934	$1,059,748	$3,489,142
Freight	$126,206	$500		$11,850	$505	$22,072	$2,212	$89,067
Products, total value	$58,433,314	$3,187,670	$3,516,314	$2,029,835	$5,271,327	$5,927,721	$9,543,164	$28,957,283
Vessels of 5 tons and over	$43,395,704	$3,018,000	$2,253,020	$1,386,868	$4,590,378	$1,993,085	$7,504,876	$22,649,477
Small boats under 5 tons	$293,551			$80,000	$8,000	$171,217		$34,334
Repair work, including rigging, calking, etc	$12,191,854	$169,520	$539,244	$467,173	$597,949	$3,704,649	$1,288,073	$5,425,246
All other products	$2,552,205	$150	$724,050	$95,794	$75,000	$58,770	$750,215	$848,226
Power:								
Number of establishments reporting	54	4	3	5	6	10	5	21
Total horsepower	66,186	925	4,329	3,466	7,919	7,213	10,904	31,430
Owned—								
Engines—								
Steam—								
Number	439	6	41	20	15	62	115	180
Horsepower	45,142	780	3,286	2,100	5,083	5,730	6,100	22,063
Gas and gasoline—								
Number	7	1				2	1	3
Horsepower	88	10				13	20	45
Water motors—								
Number	2					1		1
Horsepower	3					1		2
Electric motors—								
Number	1,121	4	76	41	312	7	172	509
Horsepower	15,157	60	1,043	1,216	2,736	305	2,736	7,061
Other power, horsepower	4,103	75				480	2,048	1,500
Rented—								
Electric motors—								
Number	100			12		49		39
Horsepower	1,563			150		684		729
Other kind, horsepower	130				100			30
Furnished to other establishments, horsepower	145						145	

[1] Includes establishments distributed as follows: California, 3; Delaware, 3; Florida, 1; Illinois, 1; Louisiana, 2; Maine, 1; Massachusetts, 3; Ohio, 3; Rhode Island, 1; Virginia, 1; Washington, 1; Wisconsin, 1.

[2] The average numbers of women and children employed during each month, being small, are not shown in this table.

TABLE 34.—WOODEN SHIPBUILDING, INCLUDING BOAT

		United States.	Alabama.	California.	Connecticut.	Delaware.
1	Number of establishments	1,043	7	38	42	7
2	Capital, total	$20,095,449	$309,406	$693,268	$1,000,143	$77,530
3	Land	$3,924,313	$36,260	$62,810	$130,610	$6,450
4	Buildings	$3,140,518	$2,150	$68,540	$68,650	$4,510
5	Machinery, tools, and implements	$5,007,590	$171,722	$251,140	$321,132	$28,230
6	Cash and sundries	$8,023,028	$99,274	$310,778	$479,751	$38,340
7	Proprietors and firm members	1,172	7	39	41	8
	Salaried officials, clerks, etc.:					
8	Total number	710	6	31	34	3
9	Total salaries	$795,444	$12,240	$47,840	$30,979	$2,400
	Officers of corporations—					
10	Number	137	2	3	6	
11	Salaries	$242,114	$4,800	$10,800	$9,700	
	General superintendents, managers, clerks, etc.—					
12	Total number	573	4	28	28	3
13	Total salaries	$553,330	$7,440	$37,040	$21,279	$2,400
	Men—					
14	Number	517	4	24	25	3
15	Salaries	$532,598	$7,440	$34,460	$20,275	$2,400
	Women—					
16	Number	56		4	3	
17	Salaries	$20,732		$2,580	$1,004	
	Wage-earners, including pieceworkers, and total wages:					
18	Greatest number employed at any one time during the year	23,880	243	1,013	938	105
19	Least number employed at any one time during the year	8,160	129	364	535	31
20	Average number	14,012	174	639	735	61
21	Total wages	$8,431,179	$92,100	$537,046	$332,253	$23,862
	Men 16 years and over—					
22	Average number	13,974	174	637	735	59
23	Wages	$8,420,409	$92,100	$536,740	$332,253	$23,567
	Women 16 years and over—					
24	Average number	21				
25	Wages	$6,902				
	Children under 16 years—					
26	Average number	17		2		2
27	Wages	$3,868		$306		$295
	Average number of wage-earners, including pieceworkers, employed during each month:[1]					
	Men 16 years and over—					
28	January	10,896	181	625	559	31
29	February	11,552	169	602	562	32
30	March	13,260	166	673	651	47
31	April	15,676	164	696	723	70
32	May	16,846	171	656	818	85
33	June	16,719	187	643	817	85
34	July	15,750	184	664	831	80
35	August	15,218	177	633	857	73
36	September	14,652	181	598	762	68
37	October	13,463	175	530	750	56
38	November	12,295	151	666	740	53
39	December	11,361	182	658	750	28
40	Miscellaneous expenses, total	$1,487,886	$10,892	$37,913	$25,342	$19,875
41	Rent of works	$203,244	$2,370	$10,250	$3,920	$650
42	Taxes	$95,766	$1,161	$2,772	$1,577	$213
43	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$796,290	$7,361	$23,683	$19,845	$1,912
44	Contract work	$392,646		$1,208		$17,100
45	Materials used, total cost	$9,861,355	$66,395	$500,349	$641,995	$39,885
46	Pig and scrap iron	$37,917		$1,495		
47	Iron and steel, plates, beams, angles, forgings, rivets, bolts and spikes, castings, etc.	$1,080,841	$4,116	$72,887	$80,300	$5,627
48	Yellow metal, including bolts and spikes	$165,088	$2,770	$15,231	$1,941	$1,054
49	Copper, sheets and pipes	$104,203		$21,215	$1,715	$208
50	Lumber, all kinds (including logs, timber, and knees)	$4,884,617	$44,650	$248,795	$348,946	$20,796
	Cordage—					
51	Wire	$98,341	$600	$4,781	$955	
52	Manila and hemp	$199,634	$1,618	$19,097	$8,543	$124
53	Oakum and pitch	$214,003	$3,181	$12,035	$10,429	$594
54	Machinery and boilers, purchased	$912,414	$100	$28,366	$56,743	$8,000
55	Anchors and chains, purchased	$140,130	$500	$6,131	$9,260	$116
56	Masts and spars, purchased	$140,806	$1,780	$3,999	$11,200	$86
57	Blocks, purchased	$54,751	$200	$2,921	$1,840	$51
58	Fuel	$162,865	$1,950	$13,410	$7,823	$412
59	Rent of power and heat	$30,729	$72	$795	$449	
60	Mill supplies	$52,517	$276	$3,540	$1,421	$106
61	All other materials	$1,502,488	$4,582	$41,407	$95,943	$1,039
62	Freight	$80,011		$4,244	$4,487	$1,672
63	Products, total value	$24,335,925	$218,355	$1,414,193	$1,372,734	$99,015
64	Vessels of 5 tons and over	$9,724,231	$32,350	$606,000	$1,075,328	$62,820
65	Small boats under 5 tons	$2,707,741	$613	$120,082	$95,744	$26,419
66	Repair work, including rigging, calking, etc	$10,637,186	$182,292	$644,956	$186,512	$9,309
67	All other products	$1,266,767	$3,100	$43,155	$15,150	$467
	Power:					
68	Number of establishments reporting	557	4	27	23	4
69	Total horsepower	27,204	250	4,367	1,085	187
	Owned—					
	Engines—					
	Steam—					
70	Number	576	5	33	19	7
71	Horsepower	24,111	230	4,125	935	187
	Gas and gasoline—					
72	Number	175		4	13	
73	Horsepower	1,697		16	117	
	Water wheels—					
74	Number	4				
75	Horsepower	67				
	Water motors—					
76	Number	3			1	
77	Horsepower	17			10	
	Electric motors—					
78	Number	16		10		
79	Horsepower	106		70		
80	Other power, horsepower	301		120		
	Rented—					
	Electric motors—					
81	Number	53	1	3	2	
82	Horsepower	804	20	31	23	
83	Other kind, horsepower	101		5		
84	Furnished to other establishments, horsepower	25				

[1] The average numbers of women and children employed during each month, being small, are not shown in this table.

BUILDING—DETAILED SUMMARY, BY STATES: 1905.

District of Columbia.	Florida.	Illinois.	Indiana.	Iowa.	Kentucky.	Louisiana.	Maine.	Maryland.	Massachusetts.	Michigan.	Minnesota.	
3	13	21	10	9	9	18	138	32	122	52	28	1
$990	$63,659	$1,094,307	$254,471	$169,597	$72,830	$82,967	$1,221,691	$1,157,254	$1,067,843	$784,715	$319,370	2
...	$17,700	$617,825	$105,950	$10,150	$8,700	$6,450	$120,715	$200,602	$215,565	$79,872	$27,875	3
...	$16,400	$252,550	$40,900	$26,635	$5,700	$10,250	$171,780	$146,697	$125,437	$126,853	$65,550	4
$190	$15,500	$112,767	$42,500	$60,031	$12,730	$22,450	$251,312	$90,853	$185,045	$136,603	$77,255	5
$800	$14,059	$111,165	$65,121	$72,781	$45,700	$43,817	$677,884	$719,102	$541,796	$441,387	$148,690	6
4	14	20	7	8	9	22	173	47	135	50	30	7
...	5	14	17	19	7	8	33	42	50	38	16	8
...	$4,780	$17,409	$17,864	$12,836	$6,580	$10,670	$34,076	$54,613	$45,183	$35,590	$14,670	9
...	2	7	6	1	4	3	8	7	15	5	...	10
...	$1,300	$10,545	$8,500	$1,000	$3,180	$4,200	$14,800	$9,495	$21,742	$8,680	...	11
...	3	7	11	18	3	5	25	35	35	43	16	12
...	$3,480	$6,864	$9,364	$11,836	$3,400	$6,470	$19,276	$45,118	$23,441	$26,910	$14,670	13
...	3	7	10	16	3	5	17	34	28	32	14	14
...	$3,480	$6,864	$9,000	$11,141	$3,400	$6,470	$17,127	$45,014	$21,157	$23,575	$13,470	15
...	...	...	1	2	...	...	8	1	7	11	2	16
...	...	...	$364	$695	...	...	$2,149	$104	$2,284	$3,335	$1,200	17
20	198	565	405	188	231	572	2,326	1,204	1,580	1,334	382	18
4	47	89	166	74	60	104	558	461	422	407	158	19
7	92	288	302	109	115	211	1,322	722	798	652	224	20
$4,185	$39,803	$179,385	$124,253	$57,520	$71,394	$122,564	$759,288	$324,839	$533,863	$297,300	$132,957	21
7	92	287	302	109	115	210	1,320	722	796	648	224	22
$4,185	$39,803	$179,055	$124,253	$57,520	$71,394	$122,414	$758,738	$324,839	$533,421	$296,097	$132,957	23
...	...	1	...	...	...	...	2	...	1	4	...	24
...	...	$330	...	...	...	...	$550	...	$364	$1,203	...	25
...	...	...	...	...	...	1	...	...	1	...	...	26
...	...	...	...	...	...	$150	...	...	$78	...	...	27
3	81	300	122	71	120	182	868	534	636	525	163	28
4	72	318	141	88	105	191	929	487	696	652	197	29
5	95	375	203	106	82	192	1,113	603	799	664	257	30
14	82	413	232	149	74	199	1,391	765	940	628	297	31
14	94	339	374	162	131	251	1,528	829	1,007	631	320	32
9	97	298	384	126	131	269	1,640	840	944	686	272	33
6	111	227	382	112	124	236	1,660	775	873	609	208	34
7	99	199	378	98	128	260	1,683	841	811	535	240	35
5	99	241	381	86	127	237	1,706	777	756	723	183	36
6	93	347	378	113	148	206	1,507	731	824	749	168	37
6	94	178	313	105	107	147	1,108	721	677	741	171	38
5	87	209	336	92	103	150	707	761	589	633	152	39
$540	$3,904	$45,658	$41,415	$24,428	$5,487	$8,120	$170,130	$66,187	$116,050	$101,393	$16,668	40
$320	$736	$2,055	$100	$400	$600	$1,181	$4,644	$10,812	$22,313	$2,706	$1,751	41
...	$405	$4,213	$1,730	$102	$658	$786	$7,946	$10,334	$6,826	$5,569	$1,594	42
$220	$2,017	$34,556	$39,585	$23,926	$4,769	$6,153	$44,008	$42,691	$51,652	$91,556	$12,198	43
...	$746	$4,834	...	...	...	...	$113,532	$2,350	$35,259	$1,562	$1,125	44
$3,455	$36,685	$117,695	$218,965	$62,966	$47,657	$94,254	$1,715,117	$423,445	$668,810	$394,965	$101,658	45
...	$112	$602	$11,520	$30	...	$15	$6,899	...	$70	$3,475	$2,225	46
$415	$2,727	$10,216	$28,110	$7,396	$2,326	$13,309	$95,508	$39,774	$70,401	$58,848	$14,545	47
...	$893	$2,095	$6,650	$1,916	$550	$2,162	$22,985	$10,549	$8,151	$12,150	$3,180	48
$50	$2,200	$450	$940	$1,021	...	$1,422	$4,842	$959	$9,492	$3,305	$3,488	49
$2,670	$16,761	$62,000	$135,040	$15,357	$33,486	$51,783	$763,150	$257,165	$331,215	$148,880	$44,964	50
...	$79	$999	$805	$10	$50	$115	$31,518	$1,922	$12,482	$2,113	$1,811	51
$40	$833	$817	$1,010	$33	$50	$225	$51,768	$5,184	$19,922	$3,553	$644	52
$72	$1,009	$4,249	$5,787	$145	$3,497	$2,314	$20,683	$11,205	$7,517	$3,365	$749	53
...	$3,200	$8,775	$1,750	$1,870	$500	$11,150	$183,967	$40,635	$69,041	$35,305	$10,660	54
...	$200	$712	$770	$64	$25	$25	$71,035	$3,274	$2,872	$7,016	$1,318	55
...	$158	$550	$205	...	...	$190	$48,969	$6,803	$22,185	$4,430	$197	56
...	$116	$602	$220	$13	$40	$10	$21,631	$1,950	$1,825	$2,233	$258	57
$8	$268	$4,682	$6,260	$3,122	$290	$2,399	$6,015	$6,084	$7,304	$7,164	$4,252	58
...	...	$60	...	...	...	...	$3,493	...	$3,291	$90	$440	59
...	$135	$1,121	$2,718	$2,452	$793	$667	$2,735	$1,669	$1,823	$2,272	$1,130	60
$200	$7,994	$17,418	$15,680	$25,333	$5,914	$7,901	$360,368	$35,426	$96,810	$94,527	$11,300	61
...	...	$2,347	$1,500	$4,204	$136	$567	$19,551	$846	$4,409	$6,239	$497	62
$9,244	$115,461	$414,085	$477,726	$170,589	$150,996	$322,601	$3,038,016	$1,024,851	$1,581,847	$943,030	$342,113	63
$2,900	$34,596	$45,670	$321,760	$22,570	$20,000	$182,813	$2,459,622	$478,283	$321,967	$273,608	$79,924	64
$894	$23,905	$46,115	$50,946	$73,598	$3,280	$7,638	$228,050	$44,170	$357,365	$318,958	$172,493	65
$5,450	$56,360	$319,310	$56,705	$31,075	$127,716	$131,893	$297,855	$471,378	$635,717	$221,309	$55,900	66
...	$600	$2,990	$48,315	$43,346	...	$257	$52,489	$31,020	$266,798	$129,155	$33,796	67
...	4	11	7	7	4	8	55	22	53	25	23	68
...	52	1,191	649	248	108	432	1,719	1,929	862	1,914	308	69
...	3	17	16	8	5	12	44	28	35	25	15	70
...	45	1,142	620	167	108	417	1,162	1,781	621	1,719	177	71
...	2	4	3	3	...	1	14	8	15	9	12	72
...	7	44	29	11	...	10	199	118	139	147	105	73
...	...	...	...	...	...	...	...	...	...	2	...	74
...	...	...	...	...	...	...	...	...	...	22	...	75
...	...	...	...	...	...	...	1	...	...	...	...	76
...	...	...	...	...	...	...	5	...	...	...	...	77
...	...	...	...	...	...	...	...	...	3	...	2	78
...	...	...	...	...	...	...	...	...	20	...	6	79
...	...	...	...	70	...	5	...	30	...	...	...	80
...	...	1	...	...	...	...	11	...	11	...	1	81
...	...	5	...	...	...	...	353	...	82	...	5	82
...	...	...	...	...	...	...	...	...	...	26	15	83
...	...	...	...	...	...	...	5	...	...	...	...	84

TABLE 34.—WOODEN SHIPBUILDING, INCLUDING BOAT

		Mississippi.	Missouri.	New Hampshire.	New Jersey.	New York.
1	Number of establishments	13	5	5	72	200
2	Capital, total	$39,750	$23,733	$5,665	$2,883,914	$4,755,836
3	Land	$6,000	$500	$400	$356,850	$1,134,407
4	Buildings	$11,375	$350	$900	$281,250	$1,125,317
5	Machinery, tools, and implements	$16,300	$8,273	$2,075	$1,092,890	$819,388
6	Cash and sundries	$6,075	$14,610	$2,290	$1,152,924	$1,676,724
7	Proprietors and firm members	14	5	6	73	231
	Salaried officials, clerks, etc.:					
8	Total number		2		54	173
9	Total salaries		$2,880		$81,718	$196,672
	Officers of corporations—					
10	Number				13	29
11	Salaries				$37,836	$51,100
	General superintendents, managers, clerks, etc.—					
12	Total number		2		41	144
13	Total salaries		$2,880		$43,882	$145,572
	Men—					
14	Number		2		40	137
15	Salaries		$2,880		$43,570	$142,423
	Women—					
16	Number				1	7
17	Salaries				$312	$3,149
	Wage-earners, including pieceworkers, and total wages:					
18	Greatest number employed at any one time during the year	168	150	8	2,213	5,321
19	Least number employed at any one time during the year	118	108	5	1,045	1,627
20	Average number	125	133	5	1,584	3,031
21	Total wages	$85,069	$99,489	$2,612	$1,042,159	$2,002,468
	Men 16 years and over—					
22	Average number	124	133	4	1,584	3,020
23	Wages	$84,949	$99,489	$2,512	$1,042,159	$1,999,127
	Women 16 years and over—					
24	Average number			1		[illegible]
25	Wages			$100		$3,100
	Children under 16 years—					
26	Average number	1				2
27	Wages	$120				$241
	Average number of wage-earners, including pieceworkers, employed during each month:					
	Men 16 years and over—					
28	January	120	147	3	1,162	2,388
29	February	121	147	3	1,247	2,628
30	March	129	147	4	1,456	2,908
31	April	135	146	7	1,702	3,679
32	May	136	146	7	1,943	3,778
33	June	122	122	3	1,914	3,862
34	July	144	125	3	1,906	3,472
35	August	141	135	3	1,827	3,332
36	September	117	132	3	1,652	3,096
37	October	116	113	4	1,495	2,516
38	November	104	119	4	1,445	2,384
39	December	103	117	4	1,259	2,197
40	Miscellaneous expenses, total	$4,643	$7,097	$279	$211,480	$375,939
41	Rent of works	$241	$3,520	$103	$22,911	$91,171
42	Taxes	$603	$60	$32	$9,228	$19,099
43	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$3,799	$3,517	$144	$89,118	$176,199
44	Contract work				$90,223	$89,470
45	Materials used, total cost	$98,875	$44,272	$4,104	$874,177	$1,900,767
46	Pig and scrap iron					$6,154
47	Iron and steel, plates, beams, angles, forgings, rivets, bolts and spikes, castings, etc	$20,540	$3,184	$115	$98,753	$268,490
48	Yellow metal, including bolts and spikes	$8,610	$874		$6,657	$31,489
49	Copper, sheets and pipes		$683	$25	$3,650	$37,939
50	Lumber, all kinds (including logs, timber, and knees)	$42,975	$24,588	$2,270	$411,853	$1,040,134
	Cordage—					
51	Wire	$2,120		$10	$2,426	$21,864
52	Manila and hemp	$2,270	$40	$25	$38,966	$19,647
53	Oakum and pitch	$1,695	$1,110	$25	$24,209	$45,469
54	Machinery and boilers, purchased	$12,000	$5,974	$544	$40,939	$100,300
55	Anchors and chains, purchased	$935	$60	$10	$4,014	$11,630
56	Masts and spars, purchased	$480	$110		$6,993	$14,735
57	Blocks, purchased	$495	$45	$3	$3,953	$9,727
58	Fuel	$675	$543	$280	$13,697	$34,884
59	Rent of power and heat		$225		$15,800	$4,730
60	Mill supplies	$428	$156	$20	$3,010	$10,307
61	All other materials	$5,602	$6,562	$752	$194,498	$235,151
62	Freight	$50	$118	$25	$4,759	$8,117
63	Products, total value	$243,747	$158,964	$11,898	$2,464,003	$5,337,582
64	Vessels of 5 tons and over	$114,800	$5,125	$1,450	$428,211	$1,614,000
65	Small boats under 5 tons	$2,996	$11,479	$8,698	$271,947	$403,470
66	Repair work, including rigging, calking, etc	$125,951	$142,360	$225	$1,656,845	$3,022,310
67	All other products			$1,525	$107,000	$297,802
	Power:					
68	Number of establishments reporting	10	4	1	37	115
69	Total horsepower	289	169	17	2,578	4,080
	Owned—					
	Engines—					
	Steam—					
70	Number	11	3	2	60	101
71	Horsepower	289	155	17	2,471	3,469
	Gas and gasoline—					
72	Number		1		10	37
73	Horsepower		6		85	279
	Water wheels—					
74	Number					2
75	Horsepower					45
	Water motors—					
76	Number				1	
77	Horsepower				2	
	Electric motors—					
78	Number					
79	Horsepower					
80	Other power, horsepower					10
	Rented—					
	Electric motors—					
81	Number		1		1	16
82	Horsepower		8		10	232
83	Other kind, horsepower				10	45
84	Furnished to other establishments, horsepower	20				

[1] Includes establishments distributed as follows: Georgia, 2; Idaho, 3; South Carolina, 1; Tennessee, 2.

BUILDING—DETAILED SUMMARY, BY STATES: 1905—Continued.

North Carolina.	Ohio.	Oregon.	Pennsylvania.	Rhode Island.	Texas.	Virginia.	Washington.	West Virginia.	Wisconsin.	All other states [1]	
12	19	11	38	15	8	23	39	3	32	8	1
$71,570	$251,312	$119,710	$570,504	$696,033	$10,905	$567,365	$690,503	$125,614	$821,888	$91,106	2
$15,550	$58,650	$49,000	$95,950	$41,500	$270	$170,675	$141,127	$6,000	$191,900	$8,000	3
$2,600	$36,350	$11,100	$47,651	$111,166	$1,425	$39,950	$69,475	$37,942	$208,240	$22,825	4
$23,160	$38,743	$37,050	$179,530	$195,125	$3,160	$218,650	$365,500	$36,813	$162,548	$28,925	5
$30,260	$117,569	$22,560	$247,373	$348,242	$6,050	$138,090	$114,401	$44,859	$259,200	$31,356	6
14	23	8	28	15	11	30	46		34	11	7
2	12	4	24	16		27	27	8	27	1	8
$1,170	$12,374	$6,900	$31,892	$32,060		$25,230	$20,213	$7,682	$28,123	$800	9
	3			5		1	5	3	9		10
	$3,740			$17,700		$864	$5,200	$3,052	$13,880		11
2	9	4	24	11		26	22	5	18	1	12
$1,170	$8,634	$6,900	$31,892	$14,360		$24,366	$15,013	$4,630	$14,243	$800	13
2	9	4	23	11		25	22	5	11	1	14
$1,170	$8,634	$6,900	$31,352	$14,360		$23,950	$15,013	$4,630	$11,643	$800	15
			1			1			7		16
			$540			$416			$2,600		17
200	456	383	638	345	71	651	931	142	757	142	18
36	138	98	315	170	24	150	361	29	247	80	19
73	246	169	413	228	30	381	501	85	459	98	20
$37,404	$122,082	$121,760	$285,597	$156,938	$22,605	$162,500	$311,882	$38,006	$255,237	$52,759	21
73	243	169	408	228	30	378	501	85	459	98	22
$37,404	$120,727	$121,760	$283,642	$156,938	$22,605	$161,877	$311,882	$38,006	$255,237	$52,759	23
	2		1								24
	$1,100		$155								25
	1		4			3					26
	$255		$1,800			$623					27
63	167	136	274	191	43	232	421	48	427	73	28
72	148	120	309	189	24	262	466	48	445	78	29
63	225	174	404	200	24	230	543	72	565	85	30
74	317	129	466	238	28	441	599	103	687	88	31
75	349	127	499	264	40	528	685	107	630	122	32
82	324	162	404	282	44	534	588	131	599	118	33
84	278	158	378	259	43	516	527	129	466	120	34
80	280	192	336	236	35	480	467	100	434	121	35
94	248	295	446	226	30	418	387	87	389	102	36
67	197	197	453	228	29	353	421	63	330	100	37
66	204	162	470	206	10	291	420	73	274	85	38
56	179	176	457	217	10	251	488	59	262	84	39
$3,492	$21,594	$7,500	$22,779	$16,642	$1,900	$18,119	$45,812	$2,356	$52,152	$2,100	40
$2,070	$2,468	$900	$3,801	$2,055	$480	$1,525	$5,256	$50	$2,035	$330	41
$512	$1,274	$1,332	$1,818	$1,474	$32	$3,079	$3,197	$550	$6,757	$773	42
$910	$17,319	$5,208	$13,021	$10,928	$1,088	$12,315	$31,459	$1,756	$22,725	$652	43
	$533		$4,139	$2,185	$300	$1,200	$5,900		$20,635	$345	44
$22,977	$162,779	$122,961	$324,467	$151,730	$16,209	$174,299	$558,935	$47,503	$173,699	$49,305	45
					$220				$5,100		46
$1,857	$9,133	$18,022	$38,601	$8,912	$900	$22,762	$35,098	$10,066	$35,238	$2,665	47
$200	$500	$5,653	$1,670	$1,883		$3,502	$6,794	$2,675	$2,304		48
	$1,000	$259	$1,812	$3,185	$200	$210	$883	$250	$100	$2,700	49
$14,292	$94,851	$68,181	$225,970	$35,149	$5,835	$40,478	$228,946	$29,328	$73,009	$21,100	50
$10	$903	$699	$4,324	$1,471	$50	$150	$5,285	$50	$654	$85	51
$110	$2,699	$1,528	$5,695	$2,963	$200	$1,070	$8,833	$206	$1,146	$775	52
$2,866	$7,413	$5,439	$11,502	$805	$681	$6,705	$11,307	$2,152	$4,163	$1,631	53
	$20,800	$6,374	$5,985	$8,970	$6,800	$39,425	$183,576	$350	$11,315	$9,000	54
$298	$909	$440	$332	$745	$18	$2,105	$13,625		$1,576	$115	55
$400	$32	$2,200	$235	$3,295	$20	$4,390	$4,104		$360	$2,700	56
$104	$134	$335	$420	$479	$15	$295	$4,027	$36	$418	$355	57
$150	$3,061	$700	$3,382	$6,472	$150	$6,256	$6,695	$920	$13,179	$378	58
		$60		$610			$254		$350	$10	59
$55	$1,938	$358	$7,758	$815	$20	$1,038	$2,197	$170	$922	$467	60
$2,548	$17,801	$10,828	$16,029	$72,843	$1,100	$44,905	$44,360	$1,000	$19,903	$6,764	61
$87	$1,605	$1,885	$752	$3,133		$1,008	$2,951	$300	$3,962	$560	62
$83,273	$374,369	$297,231	$783,428	$424,104	$51,344	$516,341	$1,076,525	$115,785	$599,878	$102,597	63
$17,925	$89,722	$78,750	$237,940	$168,982	$28,800	$109,225	$691,490	$27,180	$55,220	$35,200	64
$1,908	$111,655	$21,905	$49,928	$30,945	$12,098	$48,966	$48,535		$98,616	$14,325	65
$63,300	$164,737	$184,276	$474,170	$139,137	$10,446	$357,755	$328,932	$86,595	$401,266	$45,144	66
$140	$8,255	$12,300	$21,390	$85,040		$395	$7,568	$2,010	$44,776	$7,928	67
4	14	7	5	11	2	19	22	3	24	2	68
77	916	70	415	420	7	922	877	96	944	26	69
4	19	8	10	15		22	24	4	21	2	70
73	900	65	415	390		765	754	90	790	26	71
1	2			2	[illegible]	9	8		15		72
4	10			10	7	157	58		139		73
											74
											75
											76
											77
									1		78
									10		79
							60	6			80
		1		2			1		1		81
		5		20			5		5		82
											83
											84

THE STEAM AND STREET RAILROAD CAR INDUSTRY

THE STEAM AND STREET RAILROAD CAR INDUSTRY.

Previous to the present census, statistics for the construction and repair of street railroad cars have not been presented in a special report, although the operations of steam car manufacturers and the repair shops of steam railroads were treated in a special report entitled "Cars, Steam Railroad," which appeared in Part IV of the report on manufactures for the census of 1900. Since 1900 the growth in the building and repairing of street cars has been so remarkable that the industry has assumed proportions which entitle it to special treatment. Accordingly this report presents statistics for the manufacture and repair of street railroad cars as well as for the allied industries—the building of steam railroad cars and the work of steam railroad repair shops.

In connection with the statistics of repair work done by both street and steam railroad companies, it should be remembered that not all the value of products results from repairs upon cars. In the case of steam railroad repair shops this is especially true, since the value of repairs upon locomotives forms an item upon the reports of the railroads which nearly, if not quite, in many instances, equals the value of repairs performed upon cars. Thus the magnitude of the operations of steam railroad repair shops, which is indicated by the figures in the following pages, is due in part to the construction of and repairs on locomotives.

STEAM RAILROAD CARS AND REPAIRS.

The statistics presented for steam railroad cars and repairs show the operations of establishments classified under the heading "cars, steam railroad, not including operations of railroad companies," and "cars and general shop construction and repairs by steam railroad companies." For the sake of brevity these classifications will be denoted, respectively, as "cars, steam railroad" and "steam railroad repair shops."

In the following tables wherever horse, cable, or electric street cars are shown, they are products of secondary importance produced by plants engaged largely, and almost exclusively, in the manufacture of steam railroad cars. The figures for establishments engaged chiefly in the manufacture of street cars have been segregated and are shown in Table 17. Likewise the locomotives built in the motive power and machinery department of the railroad repair shops were secondary products, and they are included in the following tables. The report of the bridge and building department includes shop work only.

In the majority of cases the reports for the repair shops of steam railroad companies were expected to balance, namely, the value of products was to equal the expenses enumerated upon the schedules, and the few cases where this condition did not obtain were of minor importance and do not affect the value of the results.

Table 1 presents a comparative summary for the combined industry—cars, steam railroad, and steam railroad repair shops—for each census from 1890 to 1905.

TABLE 1.—*Cars, steam railroad, and steam railroad repair shops—comparative summary, with per cent of increase: 1890 to 1905.*

	CENSUS.			PER CENT OF INCREASE.	
	1905	1900	1890	1900 to 1905	1890 to 1900
Number of establishments	1,214	[1] 1,358	787	[2] 10.6	72.6
Capital	$235,122,776	$207,904,125	$119,833,687	13.1	73.5
Salaried officials, clerks, etc., number	15,640	8,462	[3] 2,661	84.8	218.0
Salaries	$14,786,686	$7,748,379	[3] $2,343,944	90.8	230.6
Wage-earners, average number	270,958	207,105	137,986	30.8	50.1
Total wages	$162,436,157	$113,049,623	$76,290,262	43.7	48.2
Men 16 years and over	270,200	206,345	137,352	30.9	50.2
Wages	$162,170,325	$112,842,153	$76,127,521	43.7	48.2
Women 16 years and over	629	471	382	33.5	23.3
Wages	$236,766	$138,878	$114,939	70.5	20.8
Children under 16 years	129	289	252	[2] 55.4	14.7
Wages	$29,066	$68,592	$47,802	[2] 57.6	43.5
Miscellaneous expenses	$10,020,541	$9,131,216	$1,820,167	9.7	401.7
Cost of materials used	$226,797,376	$171,281,760	$111,236,012	32.4	54.0
Value of products	$421,038,809	$308,748,457	$199,545,435	36.4	54.7

[1] Reduced from 1,361 to correct error in tabulation.
[2] Decrease.
[3] Includes proprietors and firm members with their salaries; number only reported in 1900 and 1905, but not included in this table.

At the census of 1890 the value of products of the combined industry was $199,545,435, which at the census of 1900 was increased by $109,203,022, or 54.7 per cent. At the census of 1905 the value of products was $421,038,809, which was an absolute increase over the total for 1900 of $112,290,352. These industries are large employers of labor and at the census of 1905 employed an average of 270,958 wage-earners during the census year, of which only 629 were women 16 years and over, and 129 were children under 16 years. For the entire period shown by the table the capital invested in the two industries practically doubled,

while the number of establishments increased only 54.3 per cent. The latter increase was not the result of uniformly progressive increases since 1890, but represents the net gain resulting from a large increase in number between 1890 and 1900 and a decrease from 1900 to 1905.

Table 2 presents statistics for the two industries separately for each census from 1890 to 1905.

TABLE 2.—CARS, STEAM RAILROAD, AND STEAM RAILROAD REPAIR SHOPS—COMPARATIVE SUMMARY, BY INDUSTRIES, WITH PER CENT OF INCREASE: 1890 TO 1905.

	CARS, STEAM RAILROAD.			PER CENT OF INCREASE.		STEAM RAILROAD REPAIR SHOPS.			PER CENT OF INCREASE.	
	1905	1900	1890	1900 to 1905	1890 to 1900	1905	1900	1890	1900 to 1905	1890 to 1900
Number of establishments	73	65	71	12.3	[1] 8.5	1,141	[2] 1,293	716	[1] 11.8	80.6
Capital	$88,179,047	$88,323,852	$43,641,210	[1] 0.2	102.4	$146,943,729	$119,580,273	$76,192,477	22.9	56.9
Salaried officials, clerks, etc., number	2,303	1,366	[3] 708	68.6	92.9	13,337	7,096	[3] 1,953	88.0	263.3
Salaries	$2,854,690	$1,538,132	[3] $759,702	85.6	102.5	$11,931,996	$6,210,247	[3] $1,584,242	92.1	292.0
Wage-earners, average number	34,058	33,453	31,354	1.8	6.7	236,900	173,652	106,632	36.4	62.9
Total wages	$20,247,821	$16,987,294	$16,076,829	19.2	5.7	$142,188,336	$96,062,329	$60,213,433	48.0	59.5
Men 16 years and over	33,896	33,136	30,904	2.3	7.2	236,304	173,209	106,448	36.4	62.7
Wages	$20,191,342	$16,902,543	$15,966,188	19.5	5.9	$141,978,983	$95,939,610	$60,161,333	48.0	59.5
Women 16 years and over	135	107	254	26.2	[1] 57.9	494	364	128	35.7	184.4
Wages	$50,875	$32,452	$75,691	56.8	[1] 57.1	$185,891	$106,426	$39,248	74.7	171.2
Children under 16 years	27	210	196	[1] 87.1	7.1	102	79	56	29.1	41.1
Wages	$5,604	$52,299	$34,950	[1] 89.3	49.6	$23,462	$16,293	$12,852	44.0	26.8
Miscellaneous expenses	$5,198,831	$2,837,229	$1,725,113	83.2	64.5	$4,821,710	$6,293,987	(4)	[1] 23.4	....
Cost of materials used	$75,657,126	$61,742,747	$44,674,486	22.5	38.2	$151,140,250	$109,539,013	$66,561,526	38.0	64.6
Value of products	$111,175,310	$90,510,180	$70,083,737	22.8	29.1	$309,863,499	$218,238,277	$129,461,698	42.0	68.6

[1] Decrease.
[2] Reduced from 1,296 to correct an error in tabulation.
[3] Includes proprietors and firm members with their salaries; number only reported in 1900 and 1905, but not included in this table.
[4] Not reported in full.

The table shows that for every statistical item presented the construction and repair work by steam railroad repair shops far exceeded in magnitude the operations of the manufacturers of steam railroad cars. At the census of 1905, 1,141, or 94 per cent, of the establishments in the combined industry were operated by steam railroad companies as repair shops, which represented an investment of $146,943,729, or 62.5 per cent of the total capital devoted to both industries. Of the wage-earners employed at this census, 236,900, or 87.4 per cent, were employed by steam railroads in construction and repair work.

Between 1900 and 1905 the number of repair shops decreased from 1,293 to 1,141, or 11.8 per cent; while the establishments engaged primarily in the manufacture of steam railroad cars increased from 65 to 73, or 12.3 per cent. The decrease in the number of repair shops is attributable largely to the introduction by the railroads of more economical methods of effecting repairs, which have resulted in the concentration of repair work in large repair shops. This concentrating movement is indicated by the figures, which show that at the census of 1905 the average investment in repair shops was $128,785, and the value of the average output was $271,571; whereas at the census of 1900 the averages for these items were, respectively, $92,483 and $168,784.

In the manufacture of steam railroad cars by establishments devoted principally to their construction, it is significant that the increase in the number of wage-earners for the entire period covered by the table was very much less than the increases in the cost of materials and value of products. Between 1900 and 1905 the last two items increased 22.5 and 22.8 per cent, respectively, or in nearly the same ratio, while the number of wage-earners increased only 1.8 per cent. This is due in part to the increased cost of materials, and to the fact that the average number of wage-earners was determined with more exactness at the census of 1905 and possibly resulted in a proportionately smaller number.

The table shows a slight decrease in the capital invested in the industry between 1900 and 1905, notwithstanding there was an increase in the number of establishments. This decrease in capital was due to the fact that during the census year 1904 one of the largest establishments in the country was practically idle, operating, on a limited scale only, the department producing steel forgings. According to the method of classification adopted by the Bureau of the Census, the nature of the products placed the entire establishment under the classification "iron and steel forgings," and the capital of several millions of dollars invested in the establishment was thus diverted from the class of cars, steam railroad, under which it was classified in 1900, when the establishment was operating normally. Thus, if this company had been operating upon a normal basis in 1904, there would have been a substantial gain instead of a slight loss in the capital invested in the industry at the census of 1905.

Products.—Table 3 shows the number and kind of steam railroad cars built at the censuses of 1900 and 1905, distributed according to the character of establishment in which they were constructed.

TABLE 3.—NUMBER, KIND, AND VALUE OF STEAM RAILROAD CARS BUILT BY ALL ESTABLISHMENTS: 1905 AND 1900.

	Census.	TOTAL.		PASSENGER.		FREIGHT.		OTHER.	
		Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Total	1905	119,940	$100,346,912	2,446	$20,486,260	115,494	$79,215,260	2,000	$645,392
	1900	145,437	87,141,518	1,369	8,810,032	143,133	77,240,632		
In steam car manufacturing establishments	1905	102,646	87,289,248	2,030	18,140,293	100,616	69,148,955		
	1900	117,569	69,529,312	979	7,368,299	116,590	62,161,013		
In steam railroad repair shops	1905	17,158	12,998,001	416	2,345,967	14,742	10,006,642	2,000	645,392
	1900	26,933	16,521,352	390	1,441,733	26,543	15,079,619		
In street car manufacturing establishments	1905	136	59,663			136	59,663		
	1900	(1)	(1)						

[1] Not reported separately.

At the census of 1905 there were 119,940 steam railroad cars, valued at $100,346,912, reported as completed during the census year, which represents a decrease of 25,497 in number and an increase of $13,205,394 in value, compared with the output reported at the census of 1900. The decrease in number was due to a marked falling off in the number of freight cars produced at the census of 1905, which was 27,639 less than the number reported in 1900. It is significant, however, that notwithstanding this decrease of 19.3 per cent in the number of freight cars, the value increased $1,974,628, indicating a remarkable increase in the average value per car. The production of passenger cars increased 1,077, or 78.7 per cent, in number and $11,676,228, or 132.6 per cent, in value, which also indicates a decided increase in the average value per car.

At the census of 1905 the steam railroad car manufacturing establishments reported 102,646 cars, valued at $87,289,248. These figures represent a decrease since 1900 of 14,923, or 12.7 per cent, in the number of cars built and a gain of $17,759,936, or 25.5 per cent, in the value of the output. In the case of the railroad repair shops there was also a decrease in the number of cars built amounting to 9,775, or 36.3 per cent, but this loss was accompanied by a decrease in value amounting to $3,523,351, or 21.3 per cent.

Of the total number of cars built in steam car manufacturing establishments at the census of 1905, 2,030 were passenger and 100,616 were freight cars. In the case of the former class of cars there was a gain since 1900 of 1,051, or 107.3 per cent, in number and $10,771,994, or 146.2 per cent, in value; while in the case of freight cars there was a loss of 15,974, or 13.7 per cent, in number and a gain of $6,987,942, or 11.2 per cent, in value. The steam railroad repair shops built 416 passenger and 14,742 freight cars during the census year 1905. The increases shown in the number and value of passenger cars produced by this class of establishments were comparatively small, whereas there were marked decreases in both the number and value of freight cars produced.

Since 1900 the production of steel railroad cars for both passenger and freight service has increased rapidly, and the substitution of steel freight cars of large tonnage and of distinct types for smaller wooden cars of rather nondescript type is progressing on the majority of the railroads as fast as conditions permit. The changes in carrying capacity are shown by the reports of the Interstate Commerce Commission on the equipment of steam railroads. As recently as 1902 there were no freight cars reported by the railroads with a capacity of 200,000 pounds, but in 1905, 200 such cars were reported. The average capacity of the 1,727,620 freight cars reported by the railroads in 1905 was 62,000 pounds, whereas the same average for the 1,505,992 freight cars reported in 1902 was 56,000 pounds. Moreover, in 1902, 1,275,742, or 84.7 per cent of the total number of freight cars reported, had a capacity of 60,000 pounds or less; whereas for 1905, 1,271,154, or only 73.6 per cent of the total number of freight cars reported, had a capacity of 60,000 pounds or less.[1] These figures indicate the cause of the decrease in number and increase in value of freight cars shown in Table 3. The greater the capacity of the car the heavier and more substantial must be the construction, and consequently fewer cars are built, while the cost is increased. The extensive and growing use of steel in the construction of the cars has contributed to the same result. Thus the average value of the freight cars produced at the census of 1905 was $686, or $147 more than the average value per car in 1900. In accepting the average value per car it must be remembered that it is based upon the total of all kinds and sizes of cars. In the case of passenger cars changes of a similar nature have resulted in an increase since 1900 of $1,940, or 30.1 per cent, in the average value per car.

At the census of 1905 the average value of the passenger cars produced in railroad car manufacturing establishments was $8,936, or $3,297 more than the

[1] Interstate Commerce Commission, "Statistics of Railroads in the United States," 1902, page 29; ibid., 1905, page 29.

average value of the same class of cars produced in railroad repair shops. This difference is due in part to the fact that the value of the cars as reported by the railroad companies was not the selling price, but represented only the sum of the building expenses as they appeared upon the report, and in part to the fact that the railroads for the most part built only the lighter coaches intended for suburban traffic, whereas the costly diners, sleeping cars, and Pullman day coaches were constructed in steam car manufacturing establishments. The average value of the freight cars built in the latter class of establishments was $687, which was $8 higher than the average value per car built by the repair shops. The lowest average value, $439, for freight cars resulted from the building operations of the street car manufacturing establishments, and was due to the fact that among the 136 cars produced by them were a number of gondolas, or ore cars, and narrow gauge freight cars.

In Table 4 is presented in detail the value, and, wherever possible, the quantity of products of the combined industries at the censuses of 1900 and 1905, for the United States, for the 10 leading states, and for the remaining states and territories combined as "all other states."

TABLE 4.—CARS, STEAM RAILROAD, AND STEAM RAILROAD REPAIR SHOPS—COMPARATIVE SUMMARY OF

	STATE.	Census.	Aggregate value.	MOTIVE POWER AND MACHINERY DEPARTMENT.					
				Total value.	Locomotives.			Work for other corporations (value).	All other products (value).
					Built.		Repaired (value).		
					Number.	Value.			
1	United States	1905	$421,038,809	$149,675,261	148	$1,853,939	$101,351,907	$5,681,307	$40,788,108
2		1900	308,748,457	94,447,260	272	3,276,393	57,383,143	3,338,589	30,449,135
3	California	1905	9,836,332	5,668,192	(3)	(3)	4,345,755	243,557	[4]1,078,880
4		1900	7,553,626	1,783,739	...	...	1,630,941	20,167	132,631
5	Illinois	1905	56,417,673	10,345,610	(3)	(3)	7,733,945	159,942	[4]2,451,723
6		1900	41,426,030	7,402,600	27	338,826	4,497,144	391,048	2,175,582
7	Indiana	1905	24,551,301	7,514,661	...	...	5,716,881	211,448	1,586,332
8		1900	19,248,999	4,363,977	1	5,709	2,983,445	143,509	1,231,314
9	Kansas	1905	11,529,394	4,759,790	(3)	(3)	3,834,826	49,535	[4]875,429
10		1900	6,816,816	2,519,320	12	142,800	1,801,317	36,003	539,200
11	Michigan	1905	18,837,142	2,726,829	(3)	(3)	1,926,803	50,292	[4]749,734
12		1900	14,253,707	1,506,894	16	107,011	1,137,222	20,783	241,878
13	Missouri	1905	20,789,659	4,342,986	(3)	(3)	3,157,967	142,038	[4]1,042,981
14		1900	14,246,889	2,482,874	2	13,545	1,559,718	229,877	679,734
15	New York	1905	22,136,696	8,266,776	(3)	(3)	6,093,988	117,155	[4]2,055,633
16		1900	21,423,201	6,864,940	2	25,114	4,218,942	324,190	2,296,694
17	Ohio	1905	26,967,635	9,763,306	...	...	6,221,964	150,696	3,390,646
18		1900	16,917,554	4,726,651	...	...	3,175,272	52,023	1,499,356
19	Pennsylvania	1905	80,449,604	32,462,711	(3)	(3)	14,602,875	2,824,809	[4]15,035,027
20		1900	62,326,081	20,409,988	166	2,303,712	8,878,878	521,698	8,705,700
21	Texas	1905	10,472,742	5,861,213	(3)	(3)	3,806,290	233,674	[4]1,821,249
22		1900	8,314,691	4,046,335	9	59,842	2,239,853	270,132	1,476,508
23	All other states	1905	139,050,631	57,963,187	(3)	(3)	43,910,613	1,498,161	[4]12,554,413
24		1900	96,220,863	38,339,942	37	279,834	25,260,411	1,329,159	11,470,538

[1] In addition to the miscellaneous products this total includes the value of street cars and value of repairs to steam cars reported by establishments classified as "cars, steam railroad."

[2] Distributed among "all other products" of the different classes in 1900.

PRODUCTS, BY KIND, QUANTITY, AND VALUE, FOR THE UNITED STATES AND TEN LEADING STATES: 1905 AND 1900.

CAR DEPARTMENT.										BRIDGE AND BUILDING DEPARTMENT (SHOPWORK).				All other products not classified (value).[2]	
Total value.	Cars built.						Passenger and freight cars repaired (value).	Work for other corporations (value).	All other products (value).[1]	Total value.	Repairs and renewals (value).	Work for other corporations (value).	All other products (value).		
	Passenger.		Freight.		Other.										
	Number.	Value.	Number.	Value.	Number.	Value.									
$260,956,745	2,446	$20,486,260	115,358	$79,155,597	2,000	$645,392	$105,341,599	$6,946,990	$48,380,907	$5,103,186	$4,358,532	$40,581	$704,073	$5,303,617	1
208,886,732	1,371	8,810,032	143,134	77,240,632	...	...	74,665,500	7,084,857	41,085,711	5,414,465	3,937,170	241,626	1,235,669	...	2
2,919,304	(3)	(3)	141	84,138	74	129,234	2,560,725	36,958	[5] 108,249	18,842	17,637	...	1,205	1,229,994	3
5,745,358	4	11,777	667	329,577	...	...	1,576,111	334,609	3,493,284	24,529	13,015	7,868	3,646	...	4
45,811,429	775	8,292,518	27,137	18,606,910	9	38,783	9,769,563	687,302	8,416,353	171,634	171,634	...	...	89,000	5
33,617,555	381	3,722,715	32,889	17,234,323	...	...	5,641,067	460,931	6,558,519	405,875	369,133	5,072	31,670	...	6
16,420,072	192	1,592,782	11,493	7,492,306	14	13,291	4,872,548	201,051	2,248,094	556,737	556,737	...	...	59,831	7
14,696,545	69	350,234	17,111	9,185,928	...	...	3,584,005	493,631	1,082,747	188,477	156,665	1,856	29,956	...	8
6,599,004	(3)	(3)	52	36,050	...	...	4,065,455	94,679	[5] 2,402,820	...	...	...	...	170,600	9
3,955,303	6	21,300	662	353,037	...	...	3,170,853	196,257	213,856	342,193	122,155	10,728	209,310	...	10
15,992,175	(3)	(3)	18,591	11,876,323	66	38,024	1,775,964	28,317	[5] 2,273,547	118,138	103,121	307	14,710	...	11
12,473,201	3	10,055	22,460	9,496,779	...	...	1,855,941	86,269	1,024,157	273,612	247,373	...	26,239	...	12
16,306,021	218	1,622,353	10,498	7,923,758	61	30,783	2,921,257	444,478	3,363,392	124,430	124,166	264	...	16,222	13
11,466,623	117	557,001	9,862	5,803,760	...	...	2,595,377	693,548	1,816,937	297,392	82,660	159,536	55,196	...	14
12,860,828	83	1,078,457	1,767	1,392,722	23	58,718	7,122,289	461,780	2,746,862	773,989	730,264	...	43,725	235,103	15
14,205,007	89	451,887	5,195	3,114,212	...	...	6,319,591	737,088	3,582,229	353,254	310,265	...	42,989	...	16
16,608,791	382	3,154,191	6,451	2,252,410	104	68,278	8,938,906	299,176	1,895,830	477,666	477,556	110	...	117,872	17
11,974,609	207	1,266,346	5,994	2,750,343	...	...	5,819,411	391,324	1,747,185	216,294	208,038	...	8,256	...	18
47,216,130	171	1,148,886	21,347	18,397,474	1,434	84,313	19,004,285	1,329,083	7,252,089	713,966	704,682	200	9,084	56,797	19
41,382,083	153	643,113	29,002	18,524,347	...	...	12,876,887	611,351	8,726,385	534,010	394,779	5,947	133,284	...	20
4,240,649	37	182,237	226	124,084	8	15,337	3,243,445	508,864	166,682	71,133	68,562	42	2,529	299,747	21
4,159,970	11	55,564	425	191,945	...	...	3,033,077	344,021	535,363	108,386	73,776	23,495	11,115	...	22
75,982,342	575	3,364,071	17,655	10,969,422	207	168,631	41,067,162	2,855,302	17,557,754	2,076,651	1,404,173	39,658	632,820	3,028,451	23
55,210,478	331	1,720,040	18,867	10,256,381	...	...	28,193,180	2,735,828	12,305,049	2,670,443	1,959,311	27,124	684,008	...	24

[3] Number and value can not be shown separately. [4] Includes value of locomotives. [5] Includes value of passenger cars.

Three classes of products are distinguished in the table: First, those produced by the motive power and machinery department, consisting principally of the repairing and building of locomotives; second, those derived from the car department, for the most part cars built and repaired; and third, those resulting from the operations of the bridge and building department, consisting of shopwork only.

At the census of 1905 the value of the product of the car department of the combined industries was $260,956,745, which constituted 62 per cent of the aggregate value of the products of the three departments. Only 148 locomotives, valued at $1,853,939, were built in the motive power and machinery department, which, when compared with the 272 locomotives, valued at $3,276,393, reported as completed by this department at the census of 1900, indicates a decrease of 45.6 per cent in number and 43.4 in value for this class of products during the five years. The value of the repair work upon locomotives was $101,351,907, or $3,989,692 less than the value of the same class of work done in the car department upon passenger and freight cars. At the census of 1900 the value of repairs upon locomotives was $57,383,143, and the value of repair work upon passenger and freight cars was $74,665,500, so that the totals for 1905 for these items represent increases over the same items in 1900 of 76.6 and 41.1 per cent, respectively. The repair work shown in the table was all reported by railroad repair shops, and thus, at the census of 1905, the aggregate value of the repairs performed by steam railroads upon their rolling stock was $206,693,506, which, since the expenses and the value of product as returned upon the reports of the railroad companies balanced in the great majority of cases, is equivalent to stating that this amount represents approximately the total cost to the railroad companies of repairs of this nature. The value of products of the bridge and building department was of comparatively small importance, amounting to but $5,103,186, or only 1.2 per cent of the value of all products.

Of the 10 leading states, Pennsylvania, with a product valued at $80,449,604 at the census of 1905 and $62,326,081 at the census of 1900, stood considerably in the lead in the combined industries at both periods, while at the census of 1905 Illinois was second, Ohio, third, and Indiana fourth. At the census of 1905 the aggregate value of products for these 4 states constituted 44.7 per cent of the total value of products for the combined industries for the United States. In the motive power and machinery department the value of the output for the state of Pennsylvania was by far the greatest, amounting to $32,462,711, or three times the value of products of the state of Illinois, which ranked next in this respect. These 2 states also led with respect to the value of products resulting from the operations of the car department of the combined industries, Pennsylvania again taking first place, with products valued at $47,216,130, and Illinois second, with products valued at $45,811,429. With respect to the number of cars built, both passenger and freight, however, Illinois was considerably ahead of any state. In the manufacture of passenger cars Ohio ranked second, building 382 cars, or about one-half the number turned out in Illinois. In the manufacture of freight cars Pennsylvania came next to the leading state, producing 21,347 freight cars, or 5,790 fewer than Illinois. The average value of the freight cars built in Pennsylvania, however, was $862, whereas in Illinois those built during the census year had, on the average, a value of only $686.

This difference between the 2 states in the average value per car is explained by the fact that in Pennsylvania the production of steel freight cars of great capacity is increasing rapidly, and in no other state has this modern class of freight cars been built in such numbers. Thus the average value per freight car built in Pennsylvania was considerably greater than that for cars of the kind produced in any of the states in which freight car building operations were at all extensive. Of the 10 states shown in the table, 6 produced over 5,000 freight cars, and the average value per car produced by each of these states was as follows: Pennsylvania, $862; Missouri, $755; Illinois, $686; Indiana, $652; Michigan, $639; and Ohio, $349. The average value, then, at the census of 1905 of the freight cars built in Pennsylvania was $107 more than the average value of cars built in Missouri, the state which returned the second largest average.

CARS, STEAM RAILROAD.

Table 5 is a summary, by geographic divisions, of the statistics returned in 1905 for cars, steam railroad.

TABLE 5.—CARS, STEAM RAILROAD—SUMMARY, BY GEOGRAPHIC DIVISIONS: 1905.

DIVISION.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
			Number.	Salaries.	Average number.	Wages.			
United States	73	$88,179,047	2,303	$2,854,690	34,058	$20,247,821	$5,198,831	$75,657,126	$111,175,310
North Atlantic[1]	20	41,657,506	846	1,197,613	8,472	4,827,879	1,763,698	19,631,217	28,443,177
South Atlantic[2]	7	5,890,732	184	214,240	3,180	1,703,222	303,754	4,947,458	7,899,356
North Central[3]	40	39,583,640	1,177	1,363,249	21,658	13,269,534	3,067,728	49,648,942	72,724,460
South Central[4]	6	1,047,169	96	79,588	748	447,186	63,651	1,429,509	2,108,317

[1] Includes New Hampshire, Massachusetts, New York, New Jersey, Pennsylvania.
[2] Includes Delaware, Maryland, West Virginia, Georgia.
[3] Includes Ohio, Indiana, Illinois, Michigan, Wisconsin, Iowa, Missouri, Kansas.
[4] Includes Kentucky, Tennessee, Alabama, and 1 establishment for Colorado in the Western division.

The table shows that the North Central division led in every statistical item with the exception of capital. In fact, this division reported 65.4 per cent of the value of products of the industry and employed 63.6 per cent of the total number of wage-earners. The North Atlantic division, with one-half as many establishments and $2,073,866 more capital than the leading division, shows a product valued at only slightly over one-third as much as that of the latter. This inconsistency in the capital invested and value of products is explained in connection with Table 6, in which the returns for Pennsylvania and Illinois will be found to be responsible for this discrepancy in the statistics of the two leading geographic divisions.

Table 6 is a comparative summary showing the statistics for the manufacture of steam railroad cars exclusive of the operations of steam railroad companies, distributed according to the leading states in this branch of the industry, for each census from 1890 to 1905.

TABLE 6.—CARS, STEAM RAILROAD—COMPARATIVE SUMMARY, BY STATES: 1890 TO 1905.

STATE.	Census.	Number of establishments.	Capital.	Salaried officials, clerks, etc.		Wage-earners and wages.		Miscellaneous expenses.	Cost of materials used.	Value of products.
				Number.	Salaries.	Average number.	Wages.			
United States	1905	73	$88,179,047	2,303	$2,854,690	34,058	$20,247,821	$5,198,831	$75,657,126	$111,175,310
	1900	65	88,323,852	1,366	1,538,132	33,453	16,987,294	2,837,229	61,742,747	90,510,180
	1890	71	43,641,210	[1] 708	[1] 759,702	31,354	16,076,829	1,725,113	44,674,486	70,083,737
Delaware	1905	3	2,707,101	102	112,424	1,559	1,031,334	169,888	1,941,642	3,599,736
	1900	3	2,429,007	73	83,528	2,032	1,041,088	121,819	1,876,435	3,274,922
	1890	3	2,839,733	46	66,459	2,301	1,329,739	87,677	1,528,528	3,291,293
Illinois	1905	16	15,467,326	628	718,968	9,036	5,930,761	1,204,095	21,172,758	30,926,464
	1900	17	18,732,466	279	330,409	9,314	5,360,756	483,271	17,075,461	24,845,606
	1890	9	10,070,784	176	128,712	6,879	4,234,407	217,384	10,093,125	17,117,223
Indiana	1905	6	5,304,214	89	108,163	3,252	1,927,573	244,382	6,844,047	10,035,971
	1900	4	6,062,000	96	111,858	3,337	1,550,764	224,009	6,287,256	9,006,577
	1890	4	5,199,706	34	50,880	3,310	1,536,141	150,782	4,924,342	7,073,329
Massachusetts	[2] 1905	4	1,499,210	26	40,978	892	513,787	73,056	1,206,763	1,956,353
Michigan	1905	4	7,783,077	156	150,027	3,831	2,200,977	602,778	9,517,495	13,467,751
	1900	4	6,693,209	107	145,795	3,187	1,409,580	227,774	7,272,761	9,920,780
	1890	5	3,769,483	85	115,868	3,723	1,565,557	245,560	8,007,974	11,078,281
Missouri	1905	5	6,686,534	197	210,607	3,185	1,843,384	713,692	8,378,555	12,069,226
	1900	4	4,530,982	117	125,561	2,772	1,373,353	198,160	5,101,335	7,722,768
	1890	5	1,442,927	50	52,247	1,854	1,147,604	75,773	2,655,320	3,974,173
New York	1905	4	2,890,856	136	142,273	1,602	984,028	93,095	2,755,043	4,250,812
	1900	4	4,299,251	[illegible]	75,920	2,091	1,038,948	81,996	3,744,911	5,228,351
	1890	5	1,835,321	53	63,342	1,961	1,100,062	92,779	2,382,777	3,166,771
Ohio	1905	5	3,297,777	83	134,919	2,065	1,197,557	195,475	3,358,171	5,539,408
	1900	5	2,581,894	61	75,616	1,805	862,011	45,450	2,791,908	3,942,372
	1890	5	2,843,166	21	38,890	2,140	991,895	92,007	2,817,578	4,784,135
Pennsylvania	1905	9	31,523,686	546	842,445	5,461	3,060,905	1,458,804	13,821,410	19,428,230
	1900	11	33,828,723	414	426,399	5,840	3,111,556	1,265,456	12,188,811	19,260,910
	1890	15	7,060,466	128	141,866	4,535	1,833,407	465,900	6,496,258	10,080,722
All other states	[3] 1905	17	11,019,266	340	393,886	3,175	1,557,515	443,566	6,661,242	9,901,359
	[4] 1900	13	9,166,320	127	163,046	3,075	1,239,238	189,294	5,403,869	7,307,894
	[5] 1890	20	8,579,624	115	101,438	4,651	2,338,017	297,251	5,768,584	9,517,810

[1] Includes proprietors and firm members with their salaries; number only reported in 1900 and 1905, but not included in this table.
[2] Included in "all other states" in 1900 and 1890.
[3] Includes establishments distributed as follows: Alabama, 2; Colorado, 1; Georgia, 2; Iowa, 1; Kansas, 1; Kentucky, 1; Maryland, 1; New Hampshire, 1; New Jersey, 2; Tennessee, 2; West Virginia, 1; Wisconsin, 2.
[4] Includes establishments distributed as follows: Alabama, 2; Georgia, 2; Kentucky, 1; Maryland, 1; Massachusetts, 2; New Hampshire, 1; New Jersey, 2; Tennessee, 1; West Virginia, 1.
[5] Includes establishments distributed as follows: Alabama, 3; California, 1; Florida, 1; Kansas, 2; Kentucky, 2; Massachusetts, 3; Minnesota, 2; New Hampshire, 1; North Carolina, 1; Tennessee, 2; Virginia, 1; West Virginia, 1.

Illinois held first rank in the manufacture of steam railroad cars by establishments not operated by railroad companies during the entire period covered by the table. The value of products for this state in 1905 was $30,926,464, which represented a gain since 1890 of $13,809,241, or 80.7 per cent, and constituted 27.8 per cent of the total value of the products of the industry in the United States. Michigan ranked next to Illinois in 1890, but relinquished this position to Pennsylvania in 1900, and has since occupied third place. In 1905 these 3 states reported aggregate products of a value of $63,822,445, or 57.4 per cent of the total for the country.

There was no material change in the total number of establishments engaged in this branch of the industry in the United States at the three census periods, although Illinois increased from 9 establishments in 1890 to 16 in 1905, and Pennsylvania decreased from 15 in 1890 to 9 in 1905. These were the only states showing a change of more than 3 establishments in 1905 as compared with 1890.

The industry has been practically at a standstill in the state of Delaware since 1890, the increase in value of products amounting to but 9.4 per cent for the fifteen years. Measured by the same standard, Pennsylvania has made slight progress in the industry during

the past five years, and in New York the industry has not even held its own, the value of the output falling off $977,539, or 18.7 per cent since 1900. Illinois is the only state which shows an increase of more than $5,000,000 for 1905, as compared with 1900, while increases of less than $5,000,000 and more than $1,000,000 are shown for Missouri, Michigan, Ohio, and Indiana. For 1900, as compared with 1890, increases of more than $5,000,000 each are shown for Pennsylvania and Illinois, and increases between $1,000,000 and $4,000,000 each for Missouri, New York, and Indiana.

Although at the census of 1905 Illinois produced an output valued at about half again as much as that of the state of Pennsylvania, yet the capital invested in the industry in the former state was not one-half as great as that invested in the industry in the latter state. This discrepancy was due in part to the inclusion of a class of assets in the capital of one of the large establishments in the state of Pennsylvania which were not included in the reports on capital of the large establishments located in Illinois. Owing to this difference in the returns of capital the relative importance of the 2 states in this industry is indicated more accurately perhaps by the number of persons employed and the value of the product. In this connection, however, it should be remembered that in the case of Illinois in the neighborhood of a third of the value of products was made up of the value of passenger cars, whereas comparatively few cars of this character were produced by establishments located in Pennsylvania, the principal production of which consists of freight cars. The prosperous condition of the manufacture of passenger cars, which is indicated by the increase in this class of cars, compared with the rather depressed condition of the freight car industry, which is indicated by the decrease in number and comparatively slight increase in value shown in Table 7 for this class of cars, gives to Illinois an apparent lead in the industry, which probably would not be so marked if the conditions for the manufacture of freight cars in Pennsylvania had been more favorable, or even upon a normal basis. In fact, it has already been pointed out that one of the largest establishments in the country, located in Pennsylvania, devoted normally to the production of this class of cars, produced none during the census year. In weighing the relative ranks of the 2 states, therefore, these conditions should be taken into account. In this case at least it is probable that the value of products fails to reflect accurately the true importance in this industry which belongs to the state of Pennsylvania under normal trade conditions.

Products.—In Table 7 is presented the total number and value of cars built by establishments classified under the industry, distributed according to kind, at the censuses of 1900 and 1905.

TABLE 7.—*Cars, steam railroad—number and value of cars built, distributed according to kind: 1905 and 1900.*

KIND.	1905	1900
Total number of cars built	103,064	118,504
Total value	$88,283,902	$70,620,166
Passenger service:		
Total number	2,030	979
Total value	$18,140,293	$7,368,299
Baggage and express—		
Number	199	72
Value	$896,185	$238,554
Chair and coach—		
Number	769	181
Value	$5,819,034	$957,526
Dining and buffet—		
Number	58	37
Value	$886,305	$404,503
Mail—		
Number	95	42
Value	$576,230	$197,465
Parlor—		
Number	114	37
Value	$1,686,417	$272,403
Passenger—		
Number	428	331
Value	$2,955,517	$1,975,469
Private—		
Number	13	11
Value	$211,658	$154,709
Sleeping—		
Number	304	194
Value	$4,775,624	$2,767,061
Other varieties—		
Number	50	74
Value	$333,323	$400,609
Freight service:		
Total number	100,616	116,590
Total value	$69,148,955	$62,161,013
Box—		
Number	38,184	47,838
Value	$28,508,632	$26,562,893
Coal and coke—		
Number	27,998	28,857
Value	$21,367,218	$18,414,718
Flat—		
Number	5,412	4,525
Value	$2,893,154	$1,923,525
Fruit—		
Number	2,840	1,620
Value	$1,727,771	$665,354
Furniture—		
Number	801	1,717
Value	$505,000	$1,148,265
Gondola—		
Number	9,518	11,821
Value	$5,518,084	$6,873,145
Refrigerator—		
Number	3,353	2,354
Value	$3,042,835	$1,956,097
Stock—		
Number	4,235	2,760
Value	$2,453,123	$1,426,800
Caboose—		
Number	160	193
Value	$150,977	$184,865
Other varieties—		
Number	8,115	14,905
Value	$2,982,161	$3,005,351
Street cars:		
Total number	418	935
Total value	$994,654	$1,090,854
Electric—		
Number	414	902
Value	$991,149	$1,062,172
Closed—		
Number	308	487
Value	$875,608	$693,143
Combination—		
Number	15	44
Value	$48,164	$68,320
Open—		
Number	8	371
Value	$7,019	$300,709
Other—		
Number	83	....
Value	$60,358	....
Horse—		
Number	4	[1] 33
Value	$3,505	[1] $28,682

[1] Includes 25 cable cars, valued at $21,232.

Of the passenger service cars produced by this industry at the census of 1905, 769, or 38 per cent, were chair and coach cars, whose value constituted 32.1 per cent of the total value of all passenger service cars constructed. At the census of 1900 the number of ordinary passenger cars built formed the largest proportion of the total number, but during the succeed-

ing five years the production of chair and coach cars quadrupled, outstripping the production of ordinary passenger cars. The average value of each variety of passenger cars shown has increased since 1900.

At both censuses the most important varieties of freight service cars, from the standpoint of number and value, were the common box cars and the coal and coke cars. Both these classes showed decreases in number and increases in value, which resulted in an average value in the case of box cars of $747 at the census of 1905, compared with an average value of $555 at the census of 1900, and an average value in the case of coal and coke cars of $763 for 1905 and $638 for 1900.

The growth in construction of freight cars for special purposes is shown by the table. At the census of 1900, 1,620 fruit cars, valued at $665,354, were built, which increased to 2,840 cars, valued at $1,727,771, at the census of 1905. The output of refrigerator cars increased 999 in number and $1,086,738 in value, and stock cars 1,475 in number and $1,026,323 in value.

The production of street cars in establishments engaged primarily in the construction of steam railroad cars is apparently decreasing, as the number of street cars produced by them fell off more than one-half during the five years between 1900 and 1905, and the value also decreased, although not to so marked an extent as the number.

Exports.—Table 8 shows by countries the value of exports of passenger and freight cars, and parts of cars, for steam railroads, at each census period from 1880 to 1905.

TABLE 8.—*Value of exports of steam railroad passenger and freight cars, and parts of same, by countries: 1880 to 1905.*[1]

COUNTRY.	1905	1900	1890	1880
Total	$1,934,352	$2,558,323	$2,689,698	$583,723
Asia:				
Chinese Empire	10,103	16,838	....	....
East Indies—British	....	2,947	....	....
Hongkong	300	....	....	....
Japan	220,152	12,589	....	48,562
Russia—Asiatic	....	898	....	....
Turkey in Asia	....	220	....	....
Oceania:				
British Australasia	21,000	50,754	9,000	10,204
Hawaii	....	15,100	5,000	....
Philippine Islands	10,780	....	....	....
Africa:				
British Africa	11,887	4,744	....	18,100
Turkey in Africa—Egypt	....	401,151	....	....

[1] Bureau of Statistics, Department of Commerce and Labor, "Commerce and Navigation of the United States."

TABLE 8.—*Value of exports of steam railroad passenger and freight cars, and parts of same, by countries: 1880 to 1905*—Continued.

COUNTRY.	1905	1900	1890	1880
Europe:				
Austria-Hungary	$80	....	....	....
Belgium	1,166	$30,713	....	....
Denmark	1,538	125	....	....
France	7,324	280,939	$33,000	....
Germany	1,832	62,319	....	$26,800
Gibraltar	....	....	....	500
Italy	2,558	52,507	....	....
Netherlands	....	1,925	....	....
Portugal	2,385	1,583	16,792	1,565
Russia—Baltic and White seas	8,010	1,300	....	....
Spain	27,915	....	43,920	....
Sweden and Norway	....	3,788	....	....
Switzerland	....	4,848	....	....
United Kingdom	65,301	124,585	190,773	61,467
North America:				
British Honduras	2,105	....	....	....
Nova Scotia, New Brunswick, etc	11,572	15,464	....	....
Quebec, Ontario, Manitoba, etc	290,516	349,078	49,900	2,100
British Columbia	44,086	12,070	....	4,716
Newfoundland and Labrador	165	232	....	....
Costa Rica	686	6,149	....	[2]23,613
Guatemala	10,363	1,271	3,500	
Honduras	4,106	2,664	....	
Nicaragua	588	4,704	26,365	
Panama	2,690	....	....	
Salvador	144	1,707	4,000	
Mexico	482,242	714,329	492,326	28,743
West Indies:				
British	1,964	253	1,747	7,400
Cuba	83,532	79,723	163,455	39,450
Porto Rico	....	8,763	....	1,863
Haiti	11,293	....	....	....
Santo Domingo	....	12,862	1,710	....
South America:				
Argentina	536,337	105,147	1,063,319	21,162
Brazil	9,518	133,378	347,222	276,683
Chile	....	8,007	169,879	....
Colombia	6,805	13,107	9,300	4,800
Ecuador	785	1,990	....	....
Guiana—British	....	12,500	700	4,485
Peru	40,930	2,692	2,800	1,510
Uruguay	....	2,150	47,500	....
Venezuela	1,594	210	7,490	....

[2] Not reported separately.

The value of the exports of steam cars decreased $623,971, or 24.4 per cent, from 1900 to 1905. There was a decided decrease in exports to the United Kingdom, France, and Germany, and to Canada and Mexico. On the other hand, the export trade in this class of commodities to certain countries shows substantial increases for the half decade: That to Japan increased $207,563; that to Argentina, $431,190; and that to Peru, $38,238. The Philippine Islands appear in the table for the first time in 1905.

STEAM RAILROAD REPAIR SHOPS.

Table 9 is a summary, by geographic divisions, of the statistics for steam railroad repair shops at the census of 1905.

TABLE 9.—STEAM RAILROAD REPAIR SHOPS—SUMMARY, BY GEOGRAPHIC DIVISIONS: 1905.

DIVISION.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
			Number.	Salaries.	Average number.	Wages.			
United States	1,141	$146,943,729	13,337	$11,931,996	236,900	$142,188,336	$4,821,710	$151,140,250	$309,863,499
North Atlantic[1]	270	54,272,332	4,073	3,357,678	70,616	42,199,050	1,800,116	51,056,924	98,319,747
South Atlantic[2]	135	11,008,934	1,370	1,175,305	27,558	14,373,361	381,841	14,240,549	30,202,383
North Central[3]	441	54,794,034	5,342	4,607,657	86,018	51,853,930	1,441,768	55,669,521	113,403,073
South Central[4]	153	14,661,078	1,532	1,580,036	31,765	18,190,402	513,979	18,037,823	38,336,404
Western[5]	142	12,207,351	1,020	1,211,320	20,943	15,571,593	684,006	12,135,433	29,601,892

[1] Includes Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania.
[2] Includes Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida.
[3] Includes Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas.
[4] Includes Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Arkansas, Indian Territory, Oklahoma, Texas.
[5] Includes Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Washington, Oregon, California, Alaska.

The North Central division ranked first in this branch of the industry as regards all the principal items except miscellaneous expenses. Of the totals for the United States, this division reported 38.7 per cent of the establishments, 37.3 per cent of the capital, and 36.6 per cent of the products. The North Atlantic division ranked second in all the principal items, except miscellaneous expenses, in which item it was first. The two leading divisions were of much greater importance than the remaining three shown in the table, the total value of the output of both being $211,722,820, or 68.3 per cent of the aggregate for the United States in this industry. Although the North Central division produced a product valued at $113,403,073, or $15,083,326 more than the North Atlantic division, yet the operations of the average establishment in the latter division were conducted on a much larger scale than those of the average repair shop in the former division. This greater concentration in the latter division is shown by the fact that the capital invested in and the value of the output of the establishments in this division were, respectively, $201,009 and $364,147, whereas the same averages for the leading division were only $124,249 and $257,150, respectively.

Table 10 is a comparative summary of the statistics of the industry, by states and territories, for each census from 1890 to 1905.

TABLE 10.—STEAM RAILROAD REPAIR SHOPS—COMPARATIVE SUMMARY, BY STATES AND TERRITORIES: 1890 TO 1905.

STATE OR TERRITORY.	Census.	Number of establishments.	Capital.	Salaried officials, clerks, etc.		Wage-earners and wages.		Miscellaneous expenses.	Cost of materials used.	Value of products.
				Number.	Salaries.	Average number.	Wages.			
United States	1905	1,141	$146,943,729	13,337	$11,931,996	236,900	$142,188,336	$4,821,710	$151,140,250	$309,863,499
	1900	1,293	119,580,273	7,096	6,210,247	173,652	96,062,329	6,293,987	109,539,013	218,238,277
	1890	716	76,192,477	1,953	1,584,242	106,632	60,213,433	(1)	66,561,526	129,461,698
Alabama	1905	16	2,104,291	239	235,123	5,501	2,992,577	134,703	3,305,735	6,681,074
	1900	19	2,019,434	118	112,795	4,030	1,941,031	86,045	2,032,166	4,172,192
	1890	12	909,911	4	2,820	1,373	761,134	(2)	784,304	1,581,207
Arizona	1905	7	523,427	39	54,200	1,159	961,296	21,504	292,308	1,329,308
	1900	7	430,119	14	21,300	576	437,238	16,454	412,490	887,482
	1890	3	72,724	2	1,414	140	112,990	(2)	74,985	189,390
Arkansas	1905	13	561,317	135	152,378	2,508	1,544,917	18,977	1,360,037	3,077,537
	1900	21	720,907	103	97,935	1,927	1,203,761	27,124	765,003	2,095,447
	1890	8	355,747	22	20,028	847	563,187	(2)	715,340	1,299,558
California	1905	28	4,046,888	271	313,456	8,251	6,067,789	203,762	3,251,325	9,836,332
	1900	29	4,429,951	119	141,798	4,920	3,507,028	76,590	3,825,340	7,553,626
	1890	10	3,139,514	29	23,840	2,858	2,151,594	(2)	2,777,306	4,923,071
Colorado	1905	34	1,646,279	215	252,850	3,052	2,264,859	78,389	2,663,085	5,259,183
	1900	29	1,681,860	137	148,040	2,687	1,676,500	38,863	1,278,299	3,141,602
	1890	10	1,551,311	26	47,700	1,366	1,023,809	(2)	894,090	1,965,696
Connecticut	1905	5	1,330,619	133	86,643	1,975	1,256,308	27,489	922,818	2,154,831
	1900	6	1,639,134	100	78,392	1,557	943,503	41,879	1,366,281	2,430,056
	1890	8	690,265	9	5,920	682	418,317	(2)	274,237	698,474
Delaware	1905	5	1,009,916	89	82,255	1,341	814,945	12,255	648,872	1,558,327
	1900	5	751,213	17	20,824	880	529,025	2,315	460,519	1,012,683
	1890	3	767,875	29	19,178	821	489,690	(2)	748,556	1,280,485
District of Columbia	1905	3	201,518	27	22,599	648	367,025	6,524	226,350	622,498
	[3] 1900	3	470,387	14	13,160	394	205,475	1,100	157,255	376,990
	1890	3	44,700	37	33,810	253	126,360	1,878	140,582	370,154
Florida	1905	6	439,845	45	45,408	1,111	561,334	5,768	543,931	1,156,441
	1900	13	414,390	33	26,663	958	486,488	19,224	579,870	1,112,245
	1890	10	158,960	7	7,160	280	144,997	1,800	201,514	354,043
Georgia	1905	28	2,102,313	223	224,935	4,777	2,415,744	77,261	2,057,669	4,775,109
	1900	32	1,408,592	97	98,003	3,175	1,602,208	89,380	1,272,692	3,062,283
	1890	11	450,512	23	19,140	966	522,657	(2)	349,844	892,610
Idaho [4]	1905	8	183,141	40	45,900	713	539,313	2,676	325,781	913,670
	1900	4	177,912	12	13,326	399	293,396	2,743	214,166	523,631
Illinois	1905	99	13,241,626	1,137	1,061,599	19,095	12,104,522	246,687	12,267,971	25,491,209
	1900	98	11,726,424	618	568,702	13,803	7,422,527	267,497	8,286,776	16,580,424
	1890	70	7,791,234	264	198,680	10,277	5,855,481	5,629	5,909,493	12,208,617
Indian Territory [5]	1905	4	88,360	22	22,430	274	184,023	15	321,663	528,131
	1900	3	8,080	3	2,820	64	35,504	87	18,224	56,635
Indiana	1905	44	5,147,248	672	589,477	11,348	6,664,212	254,893	7,006,028	14,515,330
	1900	54	4,730,231	348	290,197	8,081	4,325,101	171,355	5,454,676	10,242,422
	1890	48	3,929,805	116	93,963	6,613	3,274,288	(2)	3,904,281	7,289,382
Iowa	1905	40	3,627,832	409	371,099	6,372	3,859,893	73,245	3,302,944	7,618,721
	1900	58	3,277,617	278	249,948	5,497	2,948,947	124,453	2,896,269	6,221,378
	1890	41	2,404,648	81	65,312	3,812	2,121,824	300	2,244,274	4,473,089
Kansas	1905	23	3,041,533	253	229,502	6,196	3,929,831	102,668	7,240,670	11,521,144
	1900	37	2,931,699	175	167,786	5,592	3,476,400	101,457	3,071,173	6,816,816
	1890	26	1,683,210	60	46,949	2,819	1,722,326	(2)	1,874,646	3,644,038

[1] Not reported in full.
[2] Not reported.
[3] Includes 1 establishment in Alaska.
[4] No establishments reported in 1890.
[5] Included in "all other states" in 1890.

TABLE 10.—STEAM RAILROAD REPAIR SHOPS—COMPARATIVE SUMMARY, BY STATES AND TERRITORIES: 1890 TO 1905—Continued.

STATE OR TERRITORY.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
				Number.	Salaries.	Average number.	Wages.			
Kentucky	1905	24	$2,412,691	185	$170,305	4,588	$2,524,795	$88,154	$2,955,817	$5,739,071
	1900	25	1,761,958	96	82,689	3,572	1,841,778	55,984	2,267,578	4,248,029
	1890	9	305,229	11	10,240	623	353,200	(1)	225,485	588,925
Louisiana	1905	16	1,471,097	211	188,017	2,434	1,284,599	48,494	1,114,180	2,635,290
	1900	19	782,588	43	46,344	1,378	800,398	19,699	562,658	1,429,099
	1890	6	156,136	10	7,235	61	43,421	101	61,592	112,847
Maine	1905	15	1,024,172	28	26,676	863	457,594	21,075	684,571	1,189,916
	1900	19	921,905	37	31,332	571	300,755	35,435	487,604	857,136
	1890	10	150,672	5	4,500	239	135,275	(1)	82,536	224,113
Maryland	1905	21	2,303,354	226	204,916	4,977	2,836,848	99,915	2,610,228	5,751,908
	1900	19	2,877,954	134	100,843	3,620	1,849,737	55,163	2,567,486	4,573,229
	1890	10	2,904,677	36	52,806	2,978	1,437,658	(1)	3,588,572	5,079,035
Massachusetts	1905	22	4,494,294	198	168,226	4,004	2,521,509	58,959	3,600,110	6,348,804
	1900	16	3,056,043	111	103,962	3,031	1,822,959	32,544	1,752,564	3,712,029
	1890	14	1,988,676	25	18,711	2,264	1,279,517	(1)	1,390,705	2,712,763
Michigan	1905	34	2,462,881	201	190,932	4,435	2,496,947	82,129	2,599,383	5,369,391
	1900	42	2,527,256	182	147,119	3,938	2,026,000	39,642	2,120,166	4,332,927
	1890	17	1,226,163	32	33,340	2,098	1,119,487	(1)	1,492,487	2,645,314
Minnesota	1905	24	6,961,326	372	339,762	5,767	3,300,180	25,445	3,715,730	7,379,627
	1900	29	4,933,805	264	243,448	4,700	2,599,387	95,561	3,380,441	6,319,876
	1890	18	2,926,860	66	56,706	1,951	1,219,325	(1)	1,305,136	2,628,174
Mississippi	1905	15	1,337,132	102	107,997	2,653	1,420,876	25,082	1,332,467	2,886,422
	1900	9	741,753	45	40,754	1,534	807,899	18,336	464,034	1,331,401
	1890	5	612,744	18	19,580	1,076	677,093	(1)	632,876	1,329,549
Missouri	1905	34	2,672,946	414	365,714	6,760	4,164,684	75,148	4,111,887	8,720,433
	1900	43	3,645,260	242	219,292	5,581	3,182,753	102,500	3,019,574	6,524,121
	1890	27	1,394,974	77	67,945	2,859	1,737,771	1,637	2,082,326	3,890,542
Montana	1905	10	1,055,108	76	98,165	1,039	799,468	4,668	670,177	1,572,478
	1900	7	524,725	49	50,382	621	397,552	5,138	301,338	754,410
	1890	4	317,765	12	10,354	301	226,013	(1)	193,201	429,568
Nebraska	1905	30	5,975,358	381	189,419	3,245	2,108,816	178,008	1,917,442	4,394,685
	1900	23	3,635,267	114	100,401	2,458	1,421,284	92,946	1,009,830	2,624,461
	1890	9	1,245,519	28	20,877	2,041	1,146,206	(1)	900,825	2,067,908
Nevada	1905	6	250,888	25	26,224	315	279,887	3,785	221,893	531,789
	1900	6	404,577	8	9,800	214	168,102	7,446	110,637	295,985
	1890	6	428,999	6	8,460	209	194,643	(1)	231,893	435,084
New Hampshire	1905	7	1,044,979	43	34,065	1,007	570,229	21,114	975,051	1,600,459
	1900	9	850,873	30	24,201	966	516,990	36,763	523,347	1,101,301
	1890	4	205,465	2	2,120	141	86.804	(1)	30,612	119,555
New Jersey	1905	21	3,510,337	355	307,827	5,556	3,220,032	200,700	3,234,238	6,898,821
	1900	18	2,819,759	179	137,191	4,594	2,399,675	195,707	2,301,699	5,034,267
	1890	18	2,766,957	90	63,775	5,134	2,813,713	800	3,172,891	6,051,179
New Mexico	1905	10	936,953	69	91,263	1,667	1,228,641	64,123	1,125,278	2,509,845
	1900	7	386,721	19	18,784	1,061	585,401	1,913	463,182	1,069,280
	1890	5	137,389	4	2,525	254	174,038	(1)	177,503	354,066
New York	1905	65	11,651,993	991	836,005	14,172	7,996,695	236,162	8,777,987	17,885,884
	1900	52	11,244,747	443	344,596	13,062	6,762,504	203,221	8,879,813	16,194,850
	1890	46	4,213,639	91	75,535	8,585	4,420,441	(1)	4,527,381	9,046,025
North Carolina	1905	11	857,566	96	78,884	1,973	1,022,970	7,673	1,334,399	2,443,926
	1900	12	539,513	47	38,463	1,141	550,504	29,259	893,150	1,511,376
	1890	9	210,458	8	6,640	434	186,262	(1)	200,335	393,576
North Dakota[2]	1905	3	137,110	20	19,283	146	101,785	....	80,614	201,682
	1900	3	171,043	7	6,725	126	67,922	1,400	64,847	140,894
Ohio	1905	74	7,503,053	1,169	968,618	17,026	9,889,812	358,137	10,225,136	21,428,227
	1900	91	5,701,129	576	456,971	11,534	6,087,052	391,581	5,963,808	12,975,182
	1890	64	3,907,278	150	107,675	7,397	3,968,797	(1)	3,930,052	8,096,905
Oklahoma[3]	1900	3	9,350	3	2,405	22	13,333	117	6,736	22,591
Oregon	1905	12	390,235	49	61,983	930	677,312	140,518	386,326	1,265,139
	1900	14	725,935	29	31,678	751	495,159	15,688	483,644	1,026,169
	1890	5	2,815,997	28	26,700	1,101	907,739	(1)	781,217	1,750,926
Pennsylvania	1905	128	30,417,607	2,271	1,852,768	41,838	25,516,964	1,221,323	32,360,972	61,021,374
	1900	144	19,182,001	1,065	810,857	28,554	15,825,640	3,280,079	23,147,574	43,065,171
	1890	61	17,475,056	346	230,894	22,649	12,301,884	82,909	15,822,037	28,769,728
Rhode Island[4]	1900	3	120,900	17	14,490	215	133,300	1,770	48,596	203,326
South Carolina	1905	8	299,923	91	64,392	1,131	577,191	5,462	432,945	1,080,990
	1900	6	354,842	27	21,379	776	363,041	12,555	294,334	691,361
	1890	5	420,859	7	5,500	828	394,411	(1)	287,862	688,191
South Dakota[2]	1905	6	107,116	13	14,520	184	105,684	50	130,639	250,893
	1900	7	68,079	9	8,354	117	79,661	3,049	86,567	177,631
Tennessee	1905	16	2,028,941	179	173,436	4,760	2,616,984	70,685	2,978,340	5,839,445
	1900	16	1,319,628	65	58,606	2,817	1,459,319	66,765	1,528,363	3,113,053
	1890	10	1,198,940	15	16,672	1,772	995,287	(1)	593,819	1,605,778

[1] Not reported.
[2] Included in "all other states" in 1890.
[3] Included in "all other states" in 1905. No establishments reported in 1890.
[4] Included in "all other states" in 1905 and 1890.

TABLE 10.—STEAM RAILROAD REPAIR SHOPS—COMPARATIVE SUMMARY, BY STATES AND TERRITORIES: 1890 TO 1905—Continued.

STATE OR TERRITORY.	Census.	Number of establishments.	Capital.	Salaried officials, clerks, etc.: Number.	Salaried officials, clerks, etc.: Salaries.	Wage-earners and wages: Average number.	Wage-earners and wages: Wages.	Miscellaneous expenses.	Cost of materials used.	Value of products.
Texas	1905	47	$4,598,912	432	$499,426	8,593	$5,369,960	$127,844	$4,475,512	$10,472,742
	1900	56	3,730,792	263	292,398	6,633	4,004,769	138,838	3,878,536	8,314,691
	1890	31	1,140,049	58	61,775	2,354	1,574,786	(1)	1,223,674	2,860,235
Utah [2]	1905	7	522,140	89	93,424	1,248	964,391	2,158	826,678	1,886,651
	1900	10	496,149	46	49,389	908	636,076	16,219	604,907	1,306,591
Vermont	1905	6	623,879	29	20,982	833	450,024	11,944	377,364	860,314
	1900	7	711,261	32	23,744	779	446,017	4,614	350,401	824,776
	1890	8	534,729	.....	.....	290	157,573	(1)	153,976	311,549
Virginia	1905	29	2,740,078	401	323,351	7,345	3,663,208	98,271	4,577,393	8,693,048
	1900	28	1,733,389	283	248,425	4,922	2,452,195	45,406	3,531,283	6,277,279
	1890	8	583,022	22	13,730	1,643	833,254	(1)	658,011	1,504,995
Washington	1905	10	1,694,364	63	70,035	1,327	869,044	25,131	1,804,516	2,768,726
	1900	16	944,800	55	51,353	956	653,205	14,264	760,858	1,479,680
	1890	4	272,195	9	7,440	342	278,628	(1)	175,492	461,561
West Virginia	1905	24	1,054,421	172	128,565	4,255	2,114,096	68,712	1,808,762	4,120,136
	1900	23	1,040,311	90	67,646	2,605	1,256,640	32,355	1,586,916	2,943,557
	1890	7	533,305	14	9,217	1,022	433,335	(1)	467,841	910,393
Wisconsin	1905	30	3,916,005	301	267,732	5,444	3,127,564	45,358	3,071,077	6,511,731
	1900	46	4,206,285	272	245,163	4,502	2,398,144	138,270	3,525,144	6,306,823
	1890	22	1,681,255	50	44,778	2,148	1,217,632	(1)	898,673	2,221,152
Wyoming [2]	1905	9	900,678	76	91,382	1,212	884,005	132,357	532,617	1,640,361
	1900	7	591,725	28	29,374	853	623,046	37,194	480,199	1,169,813
All other states	[3] 1905	4	290,039	60	67,848	852	496,954	6,310	353,334	924,446
	[4] 1890	11	487,054	15	12,598	731	610,586	(1)	379,064	1,002,248

[1] Not reported.
[2] Included in "all other states" in 1890.
[3] Includes establishments distributed as follows: Alaska, 1; Oklahoma, 2; Rhode Island, 1.
[4] Includes establishments distributed as follows: Indian Territory, 2; North Dakota, 2; Rhode Island, 2; South Dakota, 2; Utah, 2; Wyoming, 1.

There were 7 states in 1905 that reported a value of products greater than $10,000,000. These states, arranged in order of value of products reported, are: Pennsylvania, Illinois, Ohio, New York, Indiana, Kansas, and Texas. Their total value of products amounted to $162,335,910, or 52.4 per cent of the total for the United States. The repair shops located in Pennsylvania performed repairs and construction work valued at $61,021,374, which was more than double the value of the work done by the repair shops located in the second state, Illinois.

Decided gains in output were reported in 1905 by all of the states except Connecticut, the products of which declined $275,225 in value during the five years. Pennsylvania reported the largest absolute increase in value of products during this period, $17,956,203, or 41.7 per cent; Illinois reported the next largest gain, $8,910,785, or 53.7 per cent; and Ohio the third largest, $8,453,045, or 65.1 per cent. These were the only states that reported a gain of more than $5,000,000 in value of products in 1905.

In 1900 the order of the states in regard to increase in value of products during the preceding period differed greatly from that shown for 1905. Pennsylvania led as in 1905, but New York and Texas were second and third, respectively, each reporting an increase of more than $5,000,000.

Several of the states reported a decreased production in 1900, but in each case they reported an increase in 1905 over the 1900 returns, the increases of 2, namely, New Jersey and Maryland, being more than $1,000,000.

Tables 11 and 12 present statistics in detail, distributed by states and territories, for each branch of the industry at the census of 1905.

TABLE 11.—CARS, STEAM RAILROAD, NOT INCLUDING OPERATIONS OF RAILROAD COMPANIES—DETAILED SUMMARY, BY STATES: 1905.

	United States.	Delaware.	Illinois.	Indiana.	Massachusetts.	Michigan.	Missouri.	New York.	Ohio.	Pennsylvania.	All other states.[1]
Number of establishments	73	3	16	6	4	4	5	4	5	9	17
Capital, total	$88,179,047	$2,707,101	$15,467,326	$5,304,214	$1,499,210	$7,783,077	$6,686,534	$2,890,856	$3,297,777	$31,523,686	$11,019,266
Land	$3,691,364	$227,500	$497,041	$212,000	$45,468	$710,500	$415,634	$372,306	$61,275	$708,953	$440,687
Buildings	$11,581,648	$565,641	$3,783,670	$810,000	$198,262	$1,019,024	$845,486	$567,330	$252,795	$2,623,799	$915,641
Machinery, tools, and implements	$11,850,405	$557,448	$2,332,697	$726,054	$198,000	$1,585,820	$738,853	$528,013	$107,760	$3,604,677	$1,471,083
Cash and sundries	$61,055,630	$1,356,512	$8,853,918	$3,556,160	$1,057,480	$4,467,733	$4,686,561	$1,423,207	$2,875,947	$24,586,257	$8,191,855
Proprietors and firm members	6	....	2	....	2	....	....	....	....	....	2
Salaried officials, clerks, etc.:											
Total number	2,303	102	628	89	26	156	197	136	83	546	340
Total salaries	$2,854,690	$112,424	$718,968	$108,163	$40,978	$150,027	$210,607	$142,273	$134,919	$842,445	$393,886
Officers of corporations—											
Number	177	4	38	7	5	4	14	6	10	58	31
Salaries	$794,739	$18,725	$183,276	$22,800	$16,300	$18,800	$43,916	$26,861	$47,100	$303,530	$113,431
General superintendents, managers, clerks, etc.—											
Total number	2,126	98	590	82	21	152	183	130	73	488	309
Total salaries	$2,059,951	$93,699	$535,692	$85,363	$24,678	$131,227	$166,691	$115,412	$87,819	$538,915	$280,455
Men—											
Number	2,052	94	573	77	19	143	174	129	69	471	303
Salaries	$2,016,874	$91,575	$526,070	$80,983	$23,274	$128,081	$161,711	$114,634	$86,290	$528,855	$275,401
Women—											
Number	74	4	17	5	2	9	9	1	4	17	6
Salaries	$43,077	$2,124	$9,622	$4,380	$1,404	$3,146	$4,980	$778	$1,529	$10,060	$5,054
Wage-earners, including pieceworkers, and total wages:											
Greatest number employed at any one time during the year	55,167	2,067	13,676	4,973	1,061	7,288	5,379	2,642	2,438	10,404	5,239
Least number employed at any one time during the year	15,843	1,027	2,975	2,025	881	566	2,232	421	1,421	1,979	2,316
Average number	34,058	1,559	9,036	3,252	892	3,831	3,185	1,602	2,065	5,461	3,175
Total wages	$20,247,821	$1,031,334	$5,930,761	$1,927,573	$513,787	$2,200,977	$1,843,384	$984,028	$1,197,557	$3,060,905	$1,557,515
Men 16 years and over—											
Average number	33,896	1,546	8,986	3,252	892	3,825	3,174	1,575	2,058	5,443	3,145
Wages	$20,191,342	$1,027,488	$5,909,759	$1,927,573	$513,787	$2,199,157	$1,839,369	$974,732	$1,195,399	$3,056,690	$1,547,388
Women 16 years and over—											
Average number	135	12	50	....	....	5	11	27	7	1	21
Wages	$50,875	$3,690	$21,002	....	....	$1,820	$4,015	$9,296	$2,158	$152	$8,742
Children under 16 years—											
Average number	27	1	....	....	....	....	....	....	....	17	9
Wages	$5,604	$156	....	....	....	....	....	....	....	$4,063	$1,385
Average number of wage-earners, including pieceworkers, employed during each month:											
Men 16 years and over—											
January	33,009	1,661	9,214	3,542	938	1,835	2,569	2,150	1,720	5,713	3,667
February	28,540	1,619	9,203	3,256	848	780	2,667	2,089	1,682	3,033	3,363
March	28,040	1,659	9,866	2,636	840	1,408	2,957	1,768	1,564	2,021	3,321
April	29,715	1,667	10,180	2,317	825	2,015	2,692	1,671	2,188	3,092	3,068
May	37,197	1,817	11,222	2,927	822	5,574	2,908	1,845	2,236	4,559	3,287
June	37,885	1,593	9,704	3,024	791	6,226	2,926	1,697	2,370	6,474	3,080
July	36,436	1,233	10,395	2,821	808	5,440	3,487	1,121	2,363	6,345	2,423
August	38,632	1,202	9,404	3,724	941	6,054	4,980	822	2,298	6,749	2,458
September	32,267	1,259	6,422	3,244	947	4,667	3,397	648	2,216	6,584	2,883
October	34,646	1,286	6,468	3,612	938	5,332	3,593	1,117	2,174	6,958	3,168
November	34,253	1,614	7,204	3,889	996	3,822	2,960	1,893	2,041	6,331	3,503
December	36,132	1,942	8,550	4,032	1,010	2,747	2,952	2,079	1,844	7,457	3,519
Women 16 years and over—											
January	175	18	64	....	....	6	12	40	5	1	29
February	157	18	60	....	....	6	12	29	5	1	26
March	157	15	59	....	....	5	12	34	5	1	26
April	158	15	61	....	....	5	12	32	7	1	25
May	165	15	65	....	....	6	12	31	10	1	25
June	152	10	63	....	....	7	11	30	9	1	21
July	117	5	56	....	....	6	10	15	10	1	14
August	118	5	57	....	....	7	10	20	7	1	11
September	56	2	12	....	....	6	10	7	8	1	10
October	73	5	13	....	....	6	9	18	7	1	14
November	122	16	36	....	....	6	11	25	6	1	21
December	170	20	54	....	....	6	11	43	5	1	30
Children under 16 years—											
January	35	1	....	....	....	....	....	....	....	24	10
February	23	1	....	....	....	....	....	....	....	12	10
March	15	1	....	....	....	....	....	....	....	4	10
April	25	1	....	....	....	....	....	....	....	14	10
May	26	1	....	....	....	....	....	....	....	15	10
June	25	1	....	....	....	....	....	....	....	15	9
July	24	1	....	....	....	....	....	....	....	15	8
August	24	1	....	....	....	....	....	....	....	16	7
September	22	1	....	....	....	....	....	....	....	14	7
October	24	1	....	....	....	....	....	....	....	15	8
November	34	1	....	....	....	....	....	....	....	24	9
December	47	1	....	....	....	....	....	....	....	36	10
Miscellaneous expenses, total	$5,198,831	$169,888	$1,204,095	$244,382	$73,056	$602,778	$713,692	$93,095	$195,475	$1,458,804	$443,566
Rent of works	$147,575	....	$73,610	$1,200	$16,000	....	$23,967	$144	$2,301	$4,024	$26,329
Taxes	$261,059	$7,958	$72,909	$23,963	$7,472	$30,113	$15,350	$16,448	$24,011	$32,338	$30,497
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$4,758,748	$161,776	$1,032,329	$218,219	$49,584	$572,665	$672,940	$76,503	$169,163	$1,419,484	$386,085
Contract work	$31,449	$154	$25,247	$1,000	....	....	$1,435	....	....	$2,958	$655
Materials used, aggregate cost	$75,657,126	$1,941,642	$21,172,758	$6,844,047	$1,206,763	$9,517,495	$8,378,555	$2,755,043	$3,358,171	$13,821,410	$6,661,242
Principal materials, total cost	$42,499,775	$671,764	$9,321,798	$3,607,600	$1,179,014	$8,751,639	$2,173,719	$1,447,038	$3,035,013	$7,741,360	$4,570,830
Purchased in raw state	$157,577	....	$6,030	$57,595	....	$12,562	$6,682	$1,348	....	$9,712	$63,648
Purchased in partially manufactured form	$42,342,198	$671,764	$9,315,768	$3,550,005	$1,179,014	$8,739,077	$2,167,037	$1,445,690	$3,035,013	$7,731,648	$4,507,182
Fuel	$1,447,703	$49,645	$330,810	$130,618	$12,776	$219,894	$174,627	$44,281	$48,853	$321,120	$115,079
Rent of power and heat	$8,034	....	$700	....	....	$3,000	$278	....	....	....	$4,056
Mill supplies	$206,068	$3,084	$42,376	$5,956	$1,497	$60,916	$5,367	$12,884	$2,921	$57,204	$13,863
All other materials	$30,804,987	$1,217,149	$11,336,888	$2,664,873	....	$440,889	$6,024,364	$1,250,340	$271,384	$5,701,726	$1,897,374
Freight	$690,559	....	$140,186	$435,000	$13,476	$41,157	$200	$500	....	....	$60,040
Products, total value	$111,175,310	$3,599,736	$30,926,464	$10,035,971	$1,956,353	$13,467,751	$12,069,226	$4,250,812	$5,539,408	$19,428,230	$9,901,359

[1] Includes establishments distributed as follows: Alabama, 2; Colorado, 1; Georgia, 2; Iowa, 1; Kansas, 1; Kentucky, 1; Maryland, 1; New Hampshire, 1; New Jersey, 2; Tennessee, 2; West Virginia, 1; Wisconsin, 2.

TABLE 11.—CARS, STEAM RAILROAD, NOT INCLUDING OPERATIONS OF RAILROAD COMPANIES—DETAILED SUMMARY, BY STATES: 1905—Continued.

	United States.	Delaware.	Illinois.	Indiana.	Massachusetts.	Michigan.	Missouri.	New York.	Ohio.	Pennsylvania.	All other states.
Power:											
Number of establishments reporting	66	3	13	5	4	4	5	3	4	9	16
Total horsepower	70,183	1,887	17,106	4,761	470	9,243	4,108	2,535	3,599	20,304	6,170
Owned—											
Engines—											
Steam—											
Number	379	12	60	34	7	22	29	14	12	123	66
Horsepower	52,261	1,623	14,130	4,760	470	6,661	3,410	2,350	1,725	12,294	4,838
Gas and gasoline—											
Number	[illegible]		2			2				2	
Horsepower	193		55			90				48	
Water wheels—											
Number	5					3					2
Horsepower	225					150					75
Electric motors—											
Number	717	23	61	1		86	20	4	76	413	33
Horsepower	14,189	170	2,276	1		2,192	452	65	1,874	6,462	697
Other power, horsepower	2,999	94	620				210	120		1,500	455
Rented—											
Electric motors—											
Number	32		3			21	3				5
Horsepower	316		25			150	36				105
Furnished to other establishments, horsepower	40										40

TABLE 12.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM

		United States.	Alabama.	Arizona.	Arkansas.	California.	Colorado.
1	Number of establishments	1,141	16	7	13	28	34
2	Capital, total	$146,943,729	$2,104,291	$523,427	$561,317	$4,046,888	$1,646,279
3	Land	$20,235,247	$181,975	$31,800	$79,239	$853,696	$183,846
4	Buildings	$51,803,520	$514,575	$272,285	$162,813	$2,055,440	$676,810
5	Machinery, tools, and implements	$38,735,146	$664,563	$183,996	$174,710	$993,184	$507,243
6	Cash and sundries	$36,169,816	$743,178	$35,346	$144,555	$144,568	$278,380
	Salaried officials, clerks, etc.:						
	General superintendents, managers, clerks, etc.—						
7	Total number	13,337	239	39	135	271	215
8	Total salaries	$11,931,996	$235,123	$54,200	$152,378	$313,456	$252,850
	Men—						
9	Number	13,135	232	39	133	268	211
10	Salaries	$11,829,974	$231,497	$54,200	$151,623	$311,387	$250,390
	Women—						
11	Number	202	7		2	3	4
12	Salaries	$102,022	$3,626		$755	$2,069	$2,460
	Wage-earners, including pieceworkers, and total wages:						
13	Greatest number employed at any one time during the year	272,638	6,052	1,326	2,843	9,345	3,623
14	Least number employed at any one time during the year	209,546	4,948	1,007	2,178	7,074	3,525
15	Average number	236,900	5,501	1,159	2,508	8,251	3,052
16	Total wages	$142,188,336	$2,992,577	$961,296	$1,544,917	$6,067,789	$2,264,859
	Men 16 years and over—						
17	Average number	236,304	5,489	1,159	2,508	8,249	3,049
18	Wages	$141,978,983	$2,989,693	$961,296	$1,544,917	$6,067,239	$2,263,268
	Women 16 years and over—						
19	Average number	494	7				3
20	Wages	$185,891	$1,343				$1,591
	Children under 16 years—						
21	Average number	102	5			2	
22	Wages	$23,462	$1,541			$550	
	Average number of wage-earners, including pieceworkers, employed during each month:						
	Men 16 years and over—						
23	January	239,096	5,677	1,153	2,536	8,147	3,015
24	February	241,518	5,707	1,145	2,461	7,820	3,028
25	March	244,083	5,749	1,067	2,573	8,266	3,062
26	April	241,946	5,661	1,146	2,521	8,130	2,913
27	May	235,127	5,337	1,164	2,446	8,414	2,930
28	June	224,035	5,164	1,069	2,374	8,408	2,781
29	July	223,406	5,157	1,145	2,310	7,656	2,879
30	August	226,917	5,240	1,173	2,481	7,987	3,012
31	September	232,073	5,487	1,196	2,506	8,092	3,082
32	October	238,178	5,598	1,174	2,579	8,538	3,261
33	November	242,110	5,633	1,201	2,625	8,698	3,253
34	December	247,159	5,458	1,275	2,684	8,832	3,372
	Women 16 years and over—						
35	January	492	7				3
36	February	494	7				3
37	March	497	7				3
38	April	497	7				3
39	May	497	7				3
40	June	484	7				3
41	July	490	7				3
42	August	491	7				3
43	September	494	7				3
44	October	498	7				3
45	November	496	7				3
46	December	498	7				3
	Children under 16 years—						
47	January	99	5				
48	February	102	5				
49	March	93	5				
50	April	97	5				
51	May	99	5				
52	June	101	5			3	
53	July	102	5			4	
54	August	101	5			3	
55	September	103	5			3	
56	October	107	5			3	
57	November	110	5			3	
58	December	110	5			5	
59	Miscellaneous expenses, total	$4,821,710	$134,703	$21,504	$18,977	$203,762	$78,389
60	Rent of works	$111,347	$325				$75
61	Taxes	$711,592	$10,685	$2,201	$3,397	$31,754	$14,916
62	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$3,946,043	$123,693	$19,303	$15,580	$167,147	$63,398
63	Contract work	$52,728				$4,861	
64	Materials used, total cost	$151,140,250	$3,305,735	$292,308	$1,360,037	$3,251,325	$2,663,085
65	Principal materials	$98,681,551	$1,802,070	$267,133	$445,484	$2,866,203	$1,694,017
66	Fuel	$5,035,506	$61,340	$14,310	$45,660	$96,550	$65,437
67	Rent of power and heat	$74,216				$30,190	$150
68	Mill supplies	$2,499,503	$57,562	$3,522	$2,116	$9,634	$165,004
69	All other materials	$44,628,036	$1,382,251	$7,343	$866,777	$247,748	$738,477
70	Freight	$221,438	$2,512			$1,000	
71	Products, aggregate value of all shopwork	$309,863,499	$6,681,074	$1,329,308	$3,077,537	$9,836,332	$5,259,183
72	Motive power and machinery department, total value	$149,675,261	$2,379,334	$623,600	$1,757,088	$5,668,192	$2,265,436
	Locomotives built [1]—						
73	Number	148					
74	Value	$1,853,939					
75	Locomotives repaired	$101,351,907	$1,749,069	$480,984	$1,296,134	$4,345,755	$1,955,346
76	Work for other corporations	$5,681,307	$81,068	$24,168	$106,465	$243,557	$45,487
77	All other products	$40,788,108	$549,197	$118,448	$354,489	$1,067,188	$264,603
78	Car department, total value	$149,781,435	$3,906,706	$301,326	$1,303,871	$2,919,304	$2,807,949
	Cars built—						
	Passenger [2]—						
79	Number	416					
80	Value	$2,345,967					
	Freight—						
81	Number	14,742	2,272		([3])	141	([3])
82	Value	$10,006,642	$1,385,977		( )	$84,138	([3])
	Other—						
83	Number	2,000		4	16	74	
84	Value	$645,392		$1,778	$8,800	$129,234	
85	Passenger and freight cars repaired	$105,341,599	$2,078,821	$296,037	$949,399	$2,560,725	$1,544,881
86	Work done for other corporations	$6,946,990	$253,657	$2,776	$238,337	$36,958	$221,329
87	All other products	$24,494,845	$188,251	$735	$103,635	$66,148	$1,026,960

[1] The number and value of locomotives can not be shown by states.
[2] The number and value of passenger cars can not be shown by states.

RAILROAD COMPANIES—DETAILED SUMMARY, BY STATES AND TERRITORIES: 1905.

Connecticut.	Delaware.	District of Columbia.	Florida.	Georgia.	Idaho.	Illinois.	Indian Territory.	Indiana.	Iowa.	Kansas.	Kentucky.	
5	5	3	6	28	8	99	4	44	40	23	24	1
$1,330,619	$1,009,916	$201,518	$439,845	$2,102,313	$183,141	$13,241,626	$88,360	$5,147,248	$3,627,832	$3,041,533	$2,412,691	2
$379,000	$14,825	$68,400	$34,860	$415,362	$30,475	$2,579,142	$4,300	$682,685	$365,529	$331,306	$484,609	3
$199,350	$584,443	$87,100	$114,140	$554,634	$59,655	$4,845,197	$31,775	$2,059,801	$1,433,899	$1,319,925	$486,385	4
$353,516	$401,916	$46,018	$182,127	$576,450	$74,453	$2,603,259	$14,390	$1,245,394	$1,271,028	$914,953	$607,306	5
$398,753	$8,732		$108,718	$555,867	$18,558	$3,214,028	$37,895	$1,159,368	$557,376	$475,349	$834,391	6
133	89	27	45	223	40	1,137	22	672	409	253	185	7
$86,643	$82,255	$22,599	$45,408	$224,935	$45,900	$1,061,599	$22,430	$589,477	$371,099	$229,502	$170,305	8
133	89	27	45	213	39	1,114	22	660	404	250	183	9
$86,643	$82,255	$22,599	$45,408	$220,314	$45,060	$1,050,969	$22,430	$582,932	$368,619	$227,388	$169,225	10
				10	1	23		12	5	3	2	11
				$4,621	$840	$10,630		$6,545	$2,480	$2,114	$1,080	12
2,364	1,602	725	1,190	5,130	764	21,520	337	12,684	7,095	6,839	5,185	13
1,669	987	558	1,047	4,491	655	16,347	142	10,080	5,682	5,564	4,220	14
1,975	1,341	648	1,111	4,777	713	19,095	274	11,348	6,372	6,196	4,588	15
$1,256,308	$814,945	$367,025	$561,334	$2,415,744	$539,313	$12,104,522	$184,023	$6,664,212	$3,859,893	$3,929,831	$2,524,795	16
1,973	1,339	614	1,110	4,767	713	19,043	274	11,333	6,366	6,189	4,580	17
$1,255,471	$814,227	$354,051	$561,063	$2,413,692	$539,313	$12,084,938	$184,023	$6,659,017	$3,857,765	$3,928,196	$2,521,841	18
2	2	34	1	10		49		15	5		8	19
$837	$718	$12,974	$271	$2,052		$18,584		$5,195	$2,036		$2,954	20
						3			1	7		21
						$1,000			$92	$1,635		22
1,965	1,313	627	1,092	4,710	724	18,825	278	11,640	6,487	6,360	4,828	23
1,963	1,429	659	1,088	4,711	722	19,400	289	11,862	6,610	6,263	4,614	24
1,944	1,512	644	1,128	4,763	700	19,693	300	12,059	6,597	6,141	4,534	25
1,976	1,488	650	1,114	4,713	657	19,317	306	11,705	6,413	6,104	4,485	26
1,932	1,303	624	1,132	4,709	673	18,601	140	11,061	6,247	6,203	4,376	27
1,931	1,105	561	1,125	4,768	704	17,836	247	10,713	5,958	5,883	4,348	28
1,887	1,078	557	1,100	4,782	709	18,728	282	10,601	6,294	5,801	4,334	29
1,896	990	530	1,135	4,800	721	18,668	228	10,681	6,241	6,066	4,393	30
1,958	1,218	600	1,114	4,798	720	19,067	280	11,028	6,245	6,215	4,463	31
2,033	1,493	615	1,098	4,773	728	19,362	295	11,283	6,344	6,277	4,630	32
2,093	1,544	630	1,088	4,792	743	19,245	311	11,506	6,457	6,450	4,911	33
2,098	1,595	671	1,106	4,885	755	19,774	323	11,857	6,499	6,505	5,044	34
	2	35	1	10		47		15	5		8	35
	2	35	1	10		47		15	5		8	36
1	2	34	1	10		48		15	5		8	37
1	2	33	1	10		47		15	5		8	38
2	2	34	1	10		46		15	5		8	39
2	2	33	1	10		45		15	5		8	40
3	2	34	1	10		54		15	5		8	41
3	2	35	1	10		53		15	5		8	42
3	2	35	1	10		51		15	5		8	43
3	2	34	1	10		52		15	5		8	44
3	2	33	1	10		52		15	5		8	45
3	2	33	1	10		46		15	5		8	46
						2				7		47
						2				7		48
						2				6		49
						2				6		50
						3				9		51
						2			2	8		52
						4			2	8		53
						4			2	7		54
						4			2	5		55
						4			2	6		56
						4			1	7		57
						4			1	7		58
$27,489	$12,255	$6,524	$5,768	$77,261	$2,676	$246,687	$15	$254,893	$73,245	$102,668	$88,154	59
				$3,025		$4,301		$100			$12,980	60
$25	$978	$84	$1,041	$19,961	$2,591	$49,544	$15	$46,332	$4,453	$20,888	$14,146	61
$27,464	$11,277	$6,440	$4,727	$54,275	$85	$192,842		$191,804	$68,792	$81,780	$56,808	62
								$16,657			$4,220	63
$922,818	$648,872	$226,350	$543,931	$2,057,669	$325,781	$12,267,971	$321,663	$7,006,028	$3,302,944	$7,240,670	$2,955,817	64
$692,652	$89,750	$89,349	$463,376	$1,459,270	$310,130	$7,869,332	$141,736	$4,909,708	$2,351,984	$5,830,286	$1,650,394	65
$36,191	$38,946	$19,217	$12,239	$40,704	$7,460	$620,593	$6,281	$245,471	$190,835	$152,235	$50,523	66
$851						$2,063		$152				67
$30.277	$2,797	$2,091	$1,259	$27,624	$2,026	$274,746	$20,931	$98,427	$112,258	$679,932	$16,916	68
$24,420	$517,379	$115,693	$66,955	$530,071	$6,165	$3,489,681	$152,715	$1,752,270	$647,867	$578,217	$1,234,927	69
$138,427			$102			$11,556					$3,057	70
$2.154,831	$1,558,327	$622,498	$1,156,441	$4,775,109	$913,670	$25,491,209	$528,131	$14,515,330	$7,618,721	$11,521,144	$5,739,071	71
$1,870.410	$1,151,963	$344,069	$612,708	$2,243,586	$672,179	$10,345,610	$311,163	$7,514,661	$3,956,360	$4,759,790	$2,218,682	72
												73
												74
$1,075,712	$443,957	$166,271	$485,604	$1,760,493	$672,179	$7,733,945	$210,142	$5,716,881	$3,141,506	$3,834,826	$1,518,277	75
	$218,131	$22,511	$16,791	$53,197		$159,942	$396	$211,448	$139,302	$49,535	$18,282	76
$794,698	$489,875	$155,287	$110,313	$429,896		$2,377,561	$100,625	$1,586,332	$615,834	$587 429	$682,123	77
$205,299	$406,364	$278,429	$450,877	$2,190,426	$241,491	$14,884,965	$216,968	$6,384,101	$3,482,886	$6,590,754	$3,490,167	78
												79
												80
				265	(3)	2,510		273		46	1,716	81
				$179,842	(3)	$1,478,804		$201,664		$29,600	$1,033,522	82
				52		9		14			15	83
				$37,425		$38,783		$13,291			$6,794	84
$205,299	$375.246	$181,727	$408,250	$1,618,057	$233,591	$9,769,563	$114,063	$4,872,548	$2,809,570	$4,065,455	$1,824,001	85
	$968	$65,585	$27.785	$66.904		$687,302	$4,306	$201,051	$83,059	$94,679	$149,654	86
		$31,117	$14,842	$285,998		$2,772,832	$98,599	$1,077,350	$590,257	$2,397,857	$424,785	87

[3] Included in "all other states."

TABLE 12.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM RAILROAD

		United States.	Alabama.	Arizona.	Arkansas.	California.	Colorado.
	Products—Continued.						
88	Bridge and building department (shopwork), total value	$5,103,186	$101,703	$404,382	$16,578	$18,842	$172,452
89	Repairs and renewals	$4,358,532	$84,814	$2,269	$16,578	$17,637	$8,181
90	Work done for other corporations	$40,581	$7,499	$875			
91	All other products	$704,073	$9,390	$401,238		$1,205	$164,271
92	All other products not classified	$5,303,617	$293,331			$1,229,994	$13,346
	Power:						
93	Number of establishments reporting	963	16	7	12	25	26
94	Total horsepower	214,719	3,630	516	1,861	5,152	2,967
	Owned—						
	Engines—						
	Steam—						
95	Number	1,768	33	9	16	32	34
96	Horsepower	143,295	3,040	267	1,117	1,316	1,948
	Gas and gasoline—						
97	Number	100		2	2	5	1
98	Horsepower	1,877		129	44	66	5
	Water wheels—						
99	Number	9				2	
100	Horsepower	202				34	
	Water motors—						
101	Number	1					
102	Horsepower	1					
	Electric motors—						
103	Number	3,028	14	2	28	12	25
104	Horsepower	46,561	505	35	700	399	545
105	Other power, horsepower	16,636	85	85		676	461
	Rented—						
	Electric motors—						
106	Number	255				89	
107	Horsepower	6,074				2,661	
108	Other kind, horsepower	73					8

COMPANIES—DETAILED SUMMARY, BY STATES AND TERRITORIES: 1905—Continued.

Connecticut.	Delaware.	District of Columbia.	Florida.	Georgia.	Idaho.	Illinois.	Indian Territory.	Indiana.	Iowa.	Kansas.	Kentucky.	
$62,217			$18,865	$104,301		$171,634		$556,737	$21,200		$12,189	88
$62,217			$18,865	$104,280		$171,634		$556,737	$21,024		$12,189	89
				$21								90
									$176			91
$16,905			$73,991	$236,796		$89,000		$59,831	$158,275	$170,600	$18,033	92
4	3	3	5	26	3	75	2	38	32	18	17	93
810	3,116	612	545	2,206	2,015	21,213	130	10,524	6,062	2,788	2,658	94
5	11	7	7	33	12	156	2	90	68	29	27	95
495	1,345	445	545	2,135	965	13,361	130	8,229	4,659	2,649	2,539	96
				1		[illegible]		1	3	1		97
				6		177		6	46	19		98
												99
												100
												101
												102
	122	10		1	68	388		53	54	2	2	103
	1,771	119		65	1,050	5,480		1,398	870	40	34	104
275		48				2,115		891	487	80	85	105
3						3						106
40						70						107
						10						108

TABLE 12.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM RAILROAD

		Louisiana.	Maine.	Maryland.	Massachusetts.	Michigan.
1	Number of establishments	16	15	21	22	34
2	Capital, total	$1,471,097	$1,024,172	$2,303,354	$4,494,294	$2,462,881
3	Land	$232,900	$60,850	$833,196	$1,220,550	$165,200
4	Buildings	$364,850	$441,728	$666,989	$1,363,100	$631,678
5	Machinery, tools, and implements	$280,534	$259,597	$657,936	$785,722	$943,487
6	Cash and sundries	$592,813	$261,997	$145,233	$1,124,922	$722,516
	Salaried officials, clerks, etc.:					
	General superintendents, managers, clerks, etc.—					
7	Total number	211	28	226	198	201
8	Total salaries	$188,017	$26,676	$204,916	$168,226	$190,932
	Men—					
9	Number	211	27	224	195	198
10	Salaries	$188,017	$26,172	$204,451	$166,476	$190,014
	Women—					
11	Number		1	2	3	3
12	Salaries		$504	$465	$1,750	$918
	Wage-earners, including pieceworkers, and total wages:					
13	Greatest number employed at any one time during the year	2,946	1,015	5,414	4,520	4,947
14	Least number employed at any one time during the year	2,105	727	4,574	3,024	3,977
15	Average number	2,434	863	4,977	4,004	4,435
16	Total wages	$1,284,599	$457,594	$2,836,848	$2,521,509	$2,496,947
	Men 16 years and over—					
17	Average number	2,434	863	4,969	3,998	4,431
18	Wages	$1,284,599	$457,594	$2,833,874	$2,519,189	$2,495,782
	Women 16 years and over—					
19	Average number			8	6	4
20	Wages			$2,974	$2,320	$1,165
	Children under 16 years—					
21	Average number					
22	Wages					
	Average number of wage-earners, including pieceworkers, employed during each month:					
	Men 16 years and over—					
23	January	2,376	860	5,148	3,749	4,482
24	February	2,377	891	5,213	4,040	4,511
25	March	2,251	855	5,172	4,124	4,552
26	April	2,270	860	5,240	4,136	4,440
27	May	2,299	800	4,896	4,140	4,336
28	June	2,266	792	4,756	4,019	4,361
29	July	2,367	817	4,720	3,870	4,300
30	August	2,476	822	4,698	3,726	4,356
31	September	2,636	857	4,616	3,787	4,369
32	October	2,633	922	4,908	4,034	4,534
33	November	2,588	924	5,038	4,152	4,444
34	December	2,669	956	5,223	4,199	4,487
	Women 16 years and over—					
35	January			8	4	4
36	February			8	5	4
37	March			8	7	4
38	April			8	7	4
39	May			8	8	4
40	June			8	7	4
41	July			8	5	4
42	August			8	4	4
43	September			8	5	4
44	October			8	6	4
45	November			8	7	4
46	December			8	7	4
	Children under 16 years—					
47	January					
48	February					
49	March					
50	April					
51	May					
52	June					
53	July					
54	August					
55	September					
56	October					
57	November					
58	December					
59	Miscellaneous expenses, total	$48,494	$21,075	$99,915	$58,959	$82,129
60	Rent of works			$500		$1,000
61	Taxes	$11,235	$5,904	$2,596	$28,184	$19,435
62	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$37,259	$15,171	$96,819	$30,775	$61,694
63	Contract work					
64	Materials used, total cost	$1,114,180	$684,571	$2,610,228	$3,600,110	$2,599,383
65	Principal materials	$443,537	$611,323	$2,110,463	$2,244,816	$2,212,895
66	Fuel	$27,947	$34,028	$90,654	$98,356	$171,211
67	Rent of power and heat		$246			
68	Mill supplies	$8,040	$2,178	$9,311	$21,395	$28,151
69	All other materials	$634,656	$36,076	$399,800	$1,235,543	$183,994
70	Freight		$720			$3,132
71	Products, aggregate value of all shopwork	$2,635,290	$1,189,916	$5,751,908	$6,348,804	$5,369,391
72	Motive power and machinery department, total value	$1,010,958	$591,853	$2,917,555	$2,283,470	$2,726,829
	Locomotives built—					
73	Number					
74	Value					
75	Locomotives repaired	$779,077	$486,383	$2,317,574	$1,921,134	$1,926,803
76	Work for other corporations	$18,484	$2,431	$14,395	$38,819	$50,292
77	All other products	$213,397	$103,039	$585,586	$323,517	$564,926
78	Car department, total value	$1,554,589	$594,744	$2,777,884	$4,045,847	$2,524,424
	Cars built—					
	Passenger—					
79	Number					
80	Value					
	Freight—					
81	Number	33	(1)	(1)	79	620
82	Value	$16,180	(1)	(1)	$54,587	$314,966
	Other—					
83	Number		4	49	5	66
84	Value		$2,421	$36,824	$15,243	$38,024
85	Passenger and freight cars repaired	$825,478	$459,312	$2,444,661	$2,506,196	$1,775,964
86	Work done for other corporations	$36,276	$46,599	$30,965	$197,766	$28,317
87	All other products	$654,105	$54,612	$261,280	$1,186,864	$363,452

(1) Included in "all other states."

COMPANIES—DETAILED SUMMARY, BY STATES AND TERRITORIES: 1905—Continued.

Minnesota.	Mississippi.	Missouri.	Montana.	Nebraska.	Nevada.	New Hampshire.	New Jersey.	New Mexico.	New York.	North Carolina.	North Dakota.	
24	15	34	10	30	6	7	21	10	65	11	3	1
$6,961,326	$1,337,132	$2,672,946	$1,055,108	$5,975,358	$250,888	$1,044,979	$3,510,337	$936,953	$11,651,993	$857,566	$137,110	2
$746,989	$107,124	$266,489	$66,340	$1,960,866	$13,000	$53,614	$330,800	$33,350	$1,014,387	$41,085	$16,000	3
$3,858,215	$309,643	$925,064	$660,231	$891,675	$88,829	$305,866	$1,412,587	$360,428	$3,372,067	$361,560	$90,148	4
$1,794,572	$423,543	$943,780	$312,207	$1,077,373	$66,067	$281,783	$1,227,851	$344,472	$2,836,967	$251,830	$22,145	5
$561,550	$496,822	$537,613	$16,330	$2,045,444	$82,992	$403,716	$539,099	$198,703	$4,428,572	$203,091	$8,817	6
372	102	414	76	381	25	43	355	69	991	98	20	7
$339,762	$107,997	$365,714	$98,165	$189,419	$26,224	$34,065	$307,827	$91,263	$836,005	$78,884	$19,283	8
368	100	404	76	381	25	43	345	69	972	96	19	9
$337,660	$106,737	$360,163	$98,165	$189,419	$26,224	$34,065	$303,051	$91,263	$827,541	$78,884	$18,563	10
4	2	10					10		19		1	11
$2,102	$1,260	$5,551					$4,776		$8,464		$720	12
6,250	3,081	7,790	1,142	3,914	424	1,047	6,427	1,885	16,902	2,177	157	13
5,317	2,307	5,950	958	2,737	350	947	4,728	1,451	12,551	1,782	137	14
5,767	2,653	6,760	1,039	3,245	315	1,007	5,556	1,667	14,172	1,973	146	15
$3,300,180	$1,420,876	$4,164,684	$799,468	$2,108,816	$279,887	$570,229	$3,220,032	$1,228,641	$7,996,695	$1,022,970	$101,785	16
5,764	2,653	6,755	1,039	3,245	315	1,004	5,535	1,662	14,156	1,969	146	17
$3,299,464	$1,420,876	$4,162,422	$799,468	$2,108,816	$279,887	$569,761	$3,212,545	$1,226,835	$7,990,436	$1,022,370	$101,785	18
		5					21		16			19
		$2,262					$7,487		$6,259			20
3						3		5		4		21
$716						$468		$1,806		$600		22
5,761	2,590	6,615	1,074	3,523	105	1,009	5,812	1,762	14,451	1,906	149	23
5,704	2,599	6,664	1,011	3,442	95	1,014	6,025	1,611	14,620	1,916	145	24
5,764	2,900	6,612	1,060	3,140	100	1,023	6,235	1,770	14,880	2,006	147	25
5,731	2,886	6,483	1,029	3,000	399	1,035	6,003	1,608	14,816	1,991	143	26
5,678	2,816	6,338	1,012	2,900	390	1,020	5,702	1,577	14,319	1,999	143	27
5,691	2,583	6,354	1,003	2,790	394	996	5,182	1,646	13,267	2,011	145	28
5,642	2,510	6,547	1,004	3,146	364	988	4,876	1,700	13,242	1,957	139	29
5,758	2,505	6,779	1,031	3,261	389	973	4,858	1,664	13,740	1,964	148	30
5,753	2,611	7,012	1,046	3,374	364	979	5,084	1,648	14,041	1,975	145	31
5,924	2,604	7,231	1,062	3,386	386	984	5,484	1,504	13,936	1,972	151	32
5,913	2,646	7,094	1,070	3,410	395	1,010	5,550	1,682	14,227	1,954	149	33
5,849	2,586	7,331	1,066	3,568	399	1,017	5,609	1,772	14,333	1,977	148	34
		5					21		17			35
		5					22		15			36
		5					20		16			37
		5					21		16			38
		5					22		16			39
		5					22		16			40
		5					21		16			41
		5					21		16			42
		5					19		16			43
		5					20		16			44
		5					21		16			45
		5					22		16			46
3						3		5		4		47
3						3		5		4		48
3						3		5		4		49
3						3		5		4		50
3						3		5		4		51
3						3		5		4		52
3						3		4		4		53
3						3		4		4		54
3						3		5		4		55
3						3		6		4		56
3						3		6		4		57
3						3		6		4		58
$25,445	$25,082	$75,148	$4,668	$178,008	$3,785	$21,114	$200,700	$64,123	$236,162	$7,673		59
		$8,325							$250	$360		60
$1,815	$4,543	$16,653	$4,668	$13,704	$1,810	$6,674	$8,223	$2,245	$63,800	$4,810		61
$23,630	$20,539	$47,170		$164,304	$1,975	$14,440	$192,477	$61,878	$166,495	$2,503		62
		$3,000							$5,617			63
$3,715,730	$1,332,467	$4,111,887	$670,177	$1,917,442	$221,893	$975,051	$3,234,238	$1,125,278	$8,777,987	$1,334,399	$80,614	64
$2,857,690	$1,034,025	$3,211,159	$581,881	$1,624,817	$173,921	$604,796	$2,301,893	$813,434	$6,605,423	$632,978	$52,460	65
$230,052	$44,892	$125,720	$42,976	$104,079	$8,232	$31,495	$131,379	$10,729	$248,260	$30,800	$19,573	66
			$1,632		$446	$7,635	$518		$8,987			67
$39,259	$8,493	$34,907	$9,800	$28,233	$1,453	$8,288	$15,576	$128,700	$48,589	$15,395	$573	68
$588,729	$245,057	$738,909	$31,910	$160,313	$37,841	$322,837	$784,872	$172,415	$1,866,678	$655,226	$8,008	69
		$1,192	$1,978						$50			70
$7,379,627	$2,886,422	$8,720,433	$1,572,478	$4,394,685	$531,789	$1,600,459	$6,898,821	$2,509,845	$17,885,884	$2,443,926	$201,682	71
$3,917,447	$1,479,889	$4,342,986	$986,341	$2,163,262	$387,007	$726,562	$3,295,000	$1,478,644	$8,266,776	$1,135,043	$157,410	72
												73
												74
$3,163,860	$849,264	$3,157,967	$884,658	$2,016,647	$332,757	$609,359	$2,185,755	$1,167,596	$6,093,988	$855,142	$141,964	75
$78,574	$76,932	$142,038	$10,383	$71,199	$24,518		$18,261	$126,085	$117,155	$2,927	$3	76
$675,013	$553,693	$1,039,981	$91,300	$16,970	$29,732	$117,203	$1,090,984	$184,963	$1,967,500	$276,974	$15,443	77
$3,351,182	$1,403,531	$4,236,795	$581,850	$2,190,595	$136,911	$755,543	$2,770,521	$1,027,737	$8,610,016	$1,185,924	$44,272	78
												79
												80
100	207	(1)		(1)	(1)	(1)			342	586		81
$70,864	$116,265	(1)		(1)	(1)	(1)			$228,727	$287,653		82
3		61		6	2	2	1		23			83
$8,398		$30,783		$4,891	$1,996	$3,475	$1,900		$58,718			84
$2,711,559	$1,068,263	$2,921,257	$580,631	$2,079,081	$114,785	$440,671	$2,352,805	$640,301	$7,122,289	$815,061	$43,919	85
$62,950	$146,198	$444,478	$1,219	$63,457	$8,730	$31,545	$126,820	$16,218	$461,780	$500	$5	86
$497,411	$69,870	$833,345		$42,397	$8,013	$221,104	$228,544	$371,218	$688,482	$73,444	$348	87

TABLE 12.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM RAILROAD

		Louisiana.	Maine.	Maryland.	Massachusetts.	Michigan.
	Products—Continued.					
88	Bridge and building department (shopwork), total value	$1,735	$1,855	$13,840	$17,113	$118,138
89	Repairs and renewals	$1,735	$1,755	$7,840	$17,113	$103,121
90	Work for other corporations		$100			$307
91	All other products			$6,000		$14,710
92	All other products not classified	$68,008	$1,464	$42,629	$2,374	
	Power:					
93	Number of establishments reporting	14	14	15	20	27
94	Total horsepower	799	1,363	5,162	2,626	4,693
	Owned—					
	Engines—					
	Steam—					
95	Number	18	10	26	21	57
96	Horsepower	795	702	2,080	2,385	4,138
	Gas and gasoline—					
97	Number	1	2	1	2	1
98	Horsepower	4	9	15	41	15
	Water wheels—					
99	Number		1			
100	Horsepower		25			
	Water motors—					
101	Number					
102	Horsepower					
	Electric motors—					
103	Number		20	60	3	48
104	Horsepower		534	917	50	540
105	Other power, horsepower		55	2,150	150	
	Rented—					
	Electric motors—					
106	Number		3			
107	Horsepower		38			
108	Other kind, horsepower					

COMPANIES—DETAILED SUMMARY, BY STATES AND TERRITORIES: 1905—Continued.

Minnesota.	Mississippi.	Missouri.	Montana.	Nebraska.	Nevada.	New Hampshire.	New Jersey.	New Mexico.	New York.	North Carolina.	North Dakota.	
$42,005	$3,002	$124,430	$4,287	$40,828	$7,178	$118,354	$420,153	$3,192	$773,989	$43,043		88
$35,715	$3,002	$124,166	$4,287	$40,828	$7,173	$118,354	$420,153	$3,192	$730,264	$42,425		89
		$264										90
$6,290					$5				$43,725	$618		91
$68,993		$16,222			$603		$413,147	$272	$235,103	$79,916		92
22	11	28	9	16	6	7	20	7	59	9	3	93
6,357	1,019	6,005	2,136	6,143	212	1,465	6,664	852	9,142	988	128	94
43	18	41	12	42	5	6	55	8	113	15	3	95
4,094	1,004	4,828	1,525	3,550	192	640	3,824	645	7,018	973	92	96
		5	2	3			11		15		1	97
		70	16	79			314		209		6	98
						2						99
						110						100
				1								101
				1								102
131		93	35	76			221	1	29		7	103
1,760		1,012	475	1,933			1,631	30	926		30	104
503	15	45	10	580		80	880	177	105			105
		1	5		1	21	1		57			106
		50	110		20	635	15		884			107
										15		108

TABLE 12.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM RAILROAD

		Ohio.	Oregon.	Pennsylvania.	South Carolina.	South Dakota.
1	Number of establishments	74	12	128	8	6
2	Capital, total	$7,503,053	$390,235	$30,417,607	$299,923	$107,116
3	Land	$717,488	$55,500	$3,785,045	$30,700	$4,840
4	Buildings	$3,260,740	$43,597	$10,047,891	$79,575	$35,225
5	Machinery, tools, and implements	$1,883,126	$108,882	$8,288,739	$117,965	$38,170
6	Cash and sundries	$1,641,699	$182,256	$8,295,932	$71,683	$28,881
	Salaried officials, clerks, etc.:					
	General superintendents, managers, clerks, etc.—					
7	Total number	1,169	49	2,271	91	13
8	Total salaries	$968,618	$61,983	$1,852,768	$64,392	$14,520
	Men—					
9	Number	1,149	49	2,238	90	13
10	Salaries	$958,430	$61,983	$1,835,856	$64,032	$14,520
	Women—					
11	Number	20		33	1	
12	Salaries	$10,188		$16,912	$360	
	Wage-earners, including pieceworkers, and total wages:					
13	Greatest number employed at any one time during the year	19,569	1,045	47,540	1,252	251
14	Least number employed at any one time during the year	14,767	825	36,450	1,017	154
15	Average number	17,026	930	41,838	1,131	184
16	Total wages	$9,889,812	$677,312	$25,516,964	$577,191	$105,684
	Men 16 years and over—					
17	Average number	16,996	930	41,573	1,122	184
18	Wages	$9,877,960	$677,312	$25,416,961	$575,624	$105,684
	Women 16 years and over—					
19	Average number	30		213	8	
20	Wages	$11,852		$88,339	$1,387	
	Children under 16 years—					
21	Average number			52	1	
22	Wages			$11,664	$180	
	Average number of wage-earners, including pieceworkers, employed during each month:					
	Men 16 years and over—					
23	January	17,725	927	42,656	1,146	179
24	February	18,096	948	43,693	1,156	181
25	March	18,575	951	44,397	1,179	183
26	April	18,192	952	44,306	1,158	181
27	May	16,664	923	43,171	1,158	183
28	June	15,666	877	38,391	1,133	165
29	July	15,539	923	37,135	1,142	163
30	August	15,762	902	38,012	1,151	188
31	September	16,132	950	39,471	1,095	200
32	October	16,749	928	41,107	1,039	191
33	November	17,064	923	42,691	1,022	194
34	December	17,788	956	43,846	1,085	200
	Women 16 years and over—					
35	January	30		217	8	
36	February	30		217	8	
37	March	30		220	8	
38	April	30		219	8	
39	May	30		217	8	
40	June	31		203	8	
41	July	30		203	8	
42	August	29		206	8	
43	September	29		211	8	
44	October	30		214	8	
45	November	30		212	8	
46	December	31		217	8	
	Children under 16 years—					
47	January			52	1	
48	February			53	1	
49	March			48	1	
50	April			52	1	
51	May			52	1	
52	June			52	1	
53	July			50	1	
54	August			49	1	
55	September			50	1	
56	October			55	1	
57	November			56	1	
58	December			55	1	
59	Miscellaneous expenses, total	$358,137	$140,518	$1,221,323	$5,462	$50
60	Rent of works	$1	$80,000		$5	
61	Taxes	$81,849	$9,883	$97,016	$3,477	$50
62	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$276,287	$37,943	$1,124,307	$1,980	
63	Contract work		$12,692			
64	Materials used, total cost	$10,225,136	$386,326	$32,360,972	$432,945	$130,639
65	Principal materials	$6,087,161	$328,606	$16,982,035	$158,824	$114,584
66	Fuel	$349,259	$14,701	$749,769	$12,162	$3,006
67	Rent of power and heat	$222	$4,758	$5,741		
68	Mill supplies	$153,420	$2,429	$199,534	$7,264	$597
69	All other materials	$3,615,717	$35,832	$14,412,391	$254,695	$12,452
70	Freight	$19,357		$11,502		
71	Products, aggregate value of all shopwork	$21,428,227	$1,265,139	$61,021,374	$1,080,990	$250,893
72	Motive power and machinery department, total value	$9,763,306	$272,507	$32,462,711	$565,240	$176,950
	Locomotives built—					
73	Number					
74	Value					
75	Locomotives repaired	$6,221,964	$258,940	$14,602,875	$513,597	$176,950
76	Work for other corporations	$150,696	$3,544	$2,824,809	$1,831	
77	All other products	$3,390,646	$10,023	$14,372,715	$49,812	
78	Car department, total value	$11,069,383	$753,749	$27,787,900	$399,738	$72,864
	Cars built—					
	Passenger—					
79	Number					
80	Value					
	Freight—					
81	Number	349	(3)	1,554		
82	Value	$184,447	(3)	$1,703,419		
	Other—					
83	Number	104		1,434		
84	Value	$68,278		$84,313		
85	Passenger and freight cars repaired	$8,938,906	$288,742	$19,004,285	$374,098	$72,864
86	Work done for other corporations	$299,176	$428,326	$1,329,083	$2,526	
87	All other products	$1,354,044	$9,184	$4,527,055	$23,114	

[1] Includes establishments distributed as follows: Alaska, 1; Oklahoma, 2; Rhode Island, 1.
[2] Represents product for all states.
[3] Included in "all other states."

COMPANIES—DETAILED SUMMARY, BY STATES AND TERRITORIES: 1905—Continued.

Tennessee.	Texas.	Utah.	Vermont.	Virginia.	Washington.	West Virginia.	Wisconsin.	Wyoming.	All other states.[1]	
10	47	7	6	29	10	24	30	9	4	1
$2,028,941	$4,598,912	$522,140	$623,879	$2,740,078	$1,694,364	$1,054,421	$3,916,005	$900,678	$290,039	2
$174,330	$362,129	$138,370	$61,900	$112,290	$256,500	$68,325	$476,101	$77,940	$30,000	3
$875,403	$1,239,338	$169,506	$270,200	$840,175	$1,039,512	$327,795	$1,620,103	$271,375	$120,200	4
$515,490	$1,285,044	$190,149	$172,629	$890,819	$350,773	$292,270	$894,437	$339,781	$42,500	5
$463,718	$1,712,401	$24,115	$119,150	$896,794	$47,579	$366,031	$925,364	$211,582	$97,339	6
179	432	89	29	401	63	172	301	76	60	7
$173,436	$499,426	$93,424	$20,982	$323,351	$70,035	$128,565	$267,732	$91,382	$67,848	8
175	429	88	23	401	63	172	297	75	58	9
$171,156	$497,206	$92,584	$19,482	$323,351	$70,035	$128,565	$265,032	$91,230	$66,708	10
4	3	1	6				4	1	2	11
$2,280	$2,220	$840	$1,500				$2,700	$152	$1,140	12
5,222	9,622	1,543	886	12,192	1,493	4,940	5,955	1,492	974	13
4,357	7,543	1,378	784	6,861	1,175	3,711	4,941	1,073	714	14
4,760	8,593	1,248	833	7,345	1,327	4,255	5,444	1,212	852	15
$2,616,984	$5,369,960	$964,391	$450,024	$3,663,208	$869,044	$2,114,096	$3,127,564	$884,005	$496,954	16
4,736	8,593	1,247	833	7,334	1,326	4,232	5,441	1,212	852	17
$2,612,389	$5,369,960	$963,781	$450,024	$3,659,591	$868,624	$2,107,987	$3,126,414	$884,005	$496,954	18
24		1		10	1	8	3			19
$4,595		$610		$3,377	$420	$3,139	$1,150			20
				1		15				21
				$240		$2,970				22
4,851	8,579	765	861	7,361	1,283	4,428	5,295	1,339	952	23
4,884	8,581	745	845	7,418	1,247	4,407	5,453	1,293	922	24
4,974	8,571	738	876	7,429	1,254	4,153	5,350	1,195	926	25
4,789	8,426	1,440	842	7,372	1,317	4,130	5,434	1,128	910	26
4,759	8,335	1,438	819	7,340	1,319	4,115	5,290	1,115	841	27
4,529	8,059	1,392	817	7,264	1,312	3,955	5,313	1,113	818	28
4,457	8,421	1,409	794	7,189	1,298	4,064	5,426	1,153	804	29
4,552	8,564	1,409	823	7,271	1,367	4,123	5,497	1,182	724	30
4,549	8,782	1,384	811	7,251	1,379	4,105	5,603	1,231	764	31
4,767	8,904	1,363	837	7,385	1,410	4,315	5,468	1,235	744	32
4,837	8,874	1,417	833	7,305	1,360	4,458	5,546	1,265	895	33
4,884	9,020	1,464	838	7,423	1,366	4,531	5,617	1,295	924	34
22		1		10	1	8	3			35
24		1		10	1	8	3			36
23		1		10	1	7	3			37
24		1		10	1	8	3			38
23		1		10	1	8	3			39
26		1		10	1	8	3			40
25		1		10	1	8	3			41
25		1		10	1	8	3			42
26		1		10	1	8	3			43
24		1		10	1	8	3			44
22		1		10	1	9	3			45
24		1		10	1	8	3			46
				1		16				47
				1		18				48
				1		15				49
				1		15				50
				1		14				51
				1		12				52
				1		13				53
				1		15				54
				1		17				55
				1		14				56
				1		16				57
				1		15				58
$70,685	$127,844	$2,158	$11,944	$98,271	$25,131	$68,712	$45,358	$132,357	$6,310	59
				$100						60
$8,045	$26,553	$1,958	$2,992	$19,829	$19,053	$10,376	$1,380	$8,228	$1,593	61
$57,269	$101,291	$200	$8,952	$78,342	$6,078	$58,336	$43,668	$124,129	$4,717	62
$5,371							$310			63
$2,978,340	$4,475,512	$826,678	$377,364	$4,577,393	$1,804,516	$1,808,762	$3,071,077	$532,617	$353,334	64
$1,962,381	$3,043,219	$654,960	$269,803	$3,376,212	$694,200	$1,180,990	$2,025,266	$466,416	$286,509	65
$60,410	$197,364	$111,322	$10,595	$95,332	$38,574	$38,838	$132,895	$38,336	$28,568	66
			$2,000		$8,505		$120			67
$18,975	$46,069	$9,202	$6,473	$17,176	$62,568	$19,417	$25,440	$11,813	$3,663	68
$936,574	$1,170,227	$51,194	$88,228	$1,088,673	$992,714	$569,517	$887,356	$16,052	$34,594	69
	$18,633		$265		$7,955					70
$5,839,445	$10,472,742	$1,886,651	$860,314	$8,693,048	$2,768,726	$4,120,136	$6,511,731	$1,640,361	$924,446	71
$1,981,970	$5,861,213	$1,017,616	$467,063	$2,957,925	$1,509,777	$1,981,510	$2,416,623	$1,173,642	$505,345	72
									[2]148	73
									[2]$1,853,939	74
$1,367,989	$3,806,290	$822,579	$346,988	$2,422,784	$614,705	$1,671,810	$1,609,712	$1,150,632	$287,083	75
$40,685	$233,674	$57,350	$18,672	$52,645	$50,036	$105	$48,994	$15,276	$214	76
$573,296	$1,799,738	$137,687	$101,403	$404,496	$845,036	$309,595	$433,760	$7,734	$218,048	77
$3,054,493	$4,240,649	$857,725	$382,239	$5,218,275	$1,209,370	$2,034,711	$3,989,379	$462,098	$394,614	78
									[2]416	79
									[2]$2,345,967	80
583	226		(3)	344	256	(3)	2,083		[4]157	81
$402,737	$124,084		(3)	$260,845	$181,967	(3)	$1,555,154		[4]$111,200	82
5	8			12	8	1	17			83
$2,962	$15,337			$8,228	$4,913	$247	$22,336			84
$2,228,425	$3,243,445	$800,915	$202,586	$2,833,756	$528,399	$1,604,352	$1,778,163	$395,030	$238,167	85
$171,493	$508,864	$23,190	$117,991	$85,563	$8,239	$786	$109,270	$24,060	$250	86
$207,519	$166,682	$33,620	$53,278	$2,002,085	$485,852	$412,535	$394,807	$43,008	$148,207	87

[4] Includes product for Arkansas, Colorado, Idaho, Maine, Maryland, Missouri, Nebraska, Nevada, New Hampshire, Oregon, Vermont, West Virginia.

TABLE 12.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM RAILROAD

		Ohio.	Oregon.	Pennsylvania.	South Carolina.	South Dakota.
	Products—Continued.					
88	Bridge and building department (shopwork), total value	$477,666	$11,894	$713,966	$16,429	$1,079
89	Repairs and renewals	$477,556	$9,203	$704,682	$16,429	$1,079
90	Work for other corporations	$110	$2,151	$200		
91	All other products		$540	$9,084		
92	All other products not classified	$117,872	$226,989	$56,797	$99,583	
	Power:					
93	Number of establishments reporting	68	11	114	7	4
94	Total horsepower	18,827	955	46,812	510	285
	Owned—					
	Engines—					
	Steam—					
95	Number	146	0	283	9	5
96	Horsepower	12,886	752	26,918	500	270
	Gas and gasoline—					
97	Number	6	1	18	1	
98	Horsepower	57	30	423	10	
	Water wheels—					
99	Number			4		
100	Horsepower			33		
	Water motors—					
101	Number					
102	Horsepower					
	Electric motors—					
103	Number	305		958		1
104	Horsepower	4,873		14,655		15
105	Other power, horsepower	988		4,382		
	Rented—					
	Electric motors—					
106	Number	2	8	26		
107	Horsepower	23	173	361		
108	Other kind, horsepower			40		

COMPANIES—DETAILED SUMMARY, BY STATES AND TERRITORIES: 1905—Continued.

Tennessee.	Texas.	Utah.	Vermont.	Virginia.	Washington.	West Virginia.	Wisconsin.	Wyoming.	All other states.	
$37,701	$71,133	$11,310	$11,012	$117,851	$17,852	$103,656	$105,729	$4,621	$7,045	88
$37,701	$68,562	$11,310	$10,327	$70,409	$17,852	$81,106	$104,761	$2,962	$7,045	89
...	$142	...	$685	$18,327	...	$10,000	...	...	...	90
...	$2,529	...	...	$29,115	...	$12,550	$968	$1,659	...	91
$765,281	$299,747	...	...	$398,997	$31,727	$259	...	...	$17,442	92
13	43	4	6	27	9	22	25	8	3	93
2,027	3,826	379	1,010	5,340	1,518	2,829	5,685	1,574	583	94
22	67	4	8	54	9	34	31	14	9	95
1,904	3,695	194	790	4,072	695	2,032	3,222	1,112	583	96
...	1	1	...	2	1	1	...	...	...	97
...	10	10	...	45	8	8	...	...	...	98
...	...	...	...	...	...	...	...	...	...	99
...	...	...	...	...	...	...	...	...	...	100
...	...	...	...	...	...	...	...	...	...	101
...	...	...	...	...	...	...	...	...	...	102
5	16	1	...	56	15	19	107	11	...	103
123	91	25	...	1,223	177	360	2,084	86	...	104
...	30	...	20	...	...	429	373	376	...	105
...	...	1	2	...	31	...	1	...	...	106
...	...	150	200	...	638	...	6	...	...	107
...	...	...	...	...	...	...	...	...	...	108

STREET RAILROAD CARS AND REPAIRS.

The census of manufactures of 1890 was the first to distinguish between the production of street railroad cars in establishments devoted principally to their construction and the building of cars in the repair shops of street railroad companies incidental to large repair operations which far exceeded in cost the few cars turned out. At the census of 1880 the statistics of the production of street cars and steam railroad cars were merged in one classification, so that no comparative figures prior to 1890 can be given. At the latter census the classification adopted to indicate the two branches of the manufacture of street cars were "cars, street railroad, not including operations of railroad companies," and "cars and general shop construction and repairs by street railroad companies," and they have been retained for this purpose since 1890. These classifications will be denoted, respectively, as "cars, street railroad," and "street railroad repair shops."

In Table 13 the statistics for both branches of the industry are combined, for each census from 1890 to 1905.

The extraordinary growth of the combined industries since 1890 is the logical result of the great development of street railroads which has taken place during the past fifteen years. During the decade between 1890 and 1900 the value of products increased $10,407,717, or 166 per cent, and for the entire period covered by the table the products nearly quadrupled in value. In marked contrast to this increase and to that in all the other items is the comparatively slight increase in the number of establishments from 1890 to 1900 and the decrease in this item which occurred from 1900 to 1905. As will appear from succeeding tables, this decrease characterized the operations of both branches of the industry and was due principally to combinations of street railroads, which has resulted in the construction of central repair shops that have taken the place of many small ones, and to the concentration of car building in large establishments devoted entirely to the construction of street railroad cars.

TABLE 13.—*Cars, street railroad, and street railroad repair shops—comparative summary, with per cent of increase: 1890 to 1905.*

	CENSUS.			PER CENT OF INCREASE.	
	1905	1900	1890	1900 to 1905	1890 to 1900
Number of establishments	100	128	95	[1]21.9	34.7
Capital	$25,881,556	$18,397,336	$4,819,477	40.7	281.7
Salaried officials, clerks, etc., number	763	345	73	121.2	372.6
Salaries	$940,933	$428,178	$106,692	119.8	301.3
Wage-earners, average number	15,782	10,610	3,794	48.7	179.7
Total wages	$9,852,377	$6,355,469	$2,502,475	55.0	154.0
Men 16 years and over	15,676	10,574	3,785	48.3	179.4
Wages	$9,819,033	$6,347,454	$2,499,895	54.7	153.9
Women 16 years and over	47	8	2	487.5	300.0
Wages	$21,341	$2,945	$780	624.6	277.6
Children under 16 years	59	28	7	110.7	300.0
Wages	$12,003	$5,070	$1,800	136.7	181.7
Miscellaneous expenses	$1,399,246	$553,693	$219,223	152.7	152.6
Cost of materials used	$10,804,804	$8,303,607	$2,854,075	30.1	190.9
Value of products	$24,281,317	$16,676,179	$6,268,462	45.6	166.0

[1] Decrease.

In Table 14 the extent of the operations and the growth since 1890 of the two industries which build and keep in repair the rolling stock of street railroads may be compared.

TABLE 14.—CARS, STREET RAILROAD, AND STREET RAILROAD REPAIR SHOPS—COMPARATIVE SUMMARY, BY INDUSTRIES, WITH PER CENT OF INCREASE: 1890 TO 1905.

	CARS, STREET RAILROAD.			PER CENT OF INCREASE.		STREET RAILROAD REPAIR SHOPS.			PER CENT OF INCREASE.	
	1905	1900	1890	1900 to 1905	1890 to 1900	1905	1900	1890	1900 to 1905	1890 to 1900
Number of establishments	14	20	17	[1]30.0	17.6	86	108	78	[1]20.4	38.5
Capital	$12,975,703	$7,615,397	$2,468,315	70.4	208.5	$12,905,853	$10,781,939	$2,351,162	19.7	358.6
Salaried officials, clerks, etc., number	264	144	48	83.3	200.0	499	201	25	148.3	704.0
Salaries	$398,246	$234,503	$83,520	69.8	180.8	$542,687	$193,675	$23,172	180.2	735.8
Wage-earners, average number	4,730	3,585	1,785	31.9	100.8	11,052	7,025	2,009	57.3	249.7
Total wages	$2,839,579	$1,950,876	$1,091,270	45.6	78.8	$7,012,798	$4,404,593	$1,411,205	59.2	212.1
Men 16 years and over	4,667	3,553	1,777	31.4	99.9	11,009	7,021	2,008	56.8	249.7
Wages	$2,823,966	$1,944,061	$1,088,930	45.3	78.5	$6,995,067	$4,403,393	$1,410,965	58.9	212.1
Women 16 years and over	9	4	2	125.0	100.0	38	4	....	850.0	....
Wages	$4,619	$1,745	$780	164.7	123.7	$16,722	$1,200	....	1,293.5	....
Children under 16 years	54	28	6	92.9	366.7	5	....	1	....	....
Wages	$10,994	$5,070	$1,560	116.8	225.0	$1,009	....	$240	....	....
Miscellaneous expenses	$980,970	$267,612	$140,462	266.6	90.5	$418,276	$286,081	$78,761	46.2	263.2
Cost of materials used	$5,341,444	$3,966,863	$1,699,235	34.7	133.4	$5,463,360	$4,336,744	$1,154,840	26.0	275.5
Value of products	$10,844,196	$7,305,368	$3,302,115	48.4	121.2	$13,437,121	$9,370,811	$2,966,347	43.4	215.9

[1] Decrease.

Of the total of 100 establishments engaged in the combined industry at the census of 1905, 86 were street railroad repair shops. Notwithstanding the fact that there were six times as many repair shops as establishments engaged primarily in the manufacture of street railroad cars, the latter represented an investment of $12,975,703, or 50.1 per cent of the capital employed in the combined industry, and produced a

product valued at $10,844,196, or 44.7 per cent of the value of the combined products of the two branches of the industry. The repair shops, however, employed 11,052 wage-earners and paid in wages $7,012,798, which constituted 70 and 71.2 per cent, respectively, of the total for the combined industries.

Indications of the difference in the nature of the work performed by the two classes of establishments are developed by a comparison of the statistics of the number of wage-earners employed, the cost of materials, and the value of the products resulting from their operations. The repair work of the street railroad repair shops in general consists largely of labor unassisted, or assisted but little, by machinery, operating upon materials often already in position; whereas in the construction of street cars on a large scale labor is augmented by machinery wherever possible, and the comparatively large quantity of new work resulting necessarily involves the expenditure of a larger sum for materials in proportion to the value of the products than is the case with the repair shops. Thus, at the census of 1905 the cost of labor and the cost of materials constituted 26.2 per cent and 49.2 per cent, respectively, of the value of the products produced by the manufacturers of street cars, and 52.2 per cent and 40.6 per cent, respectively, of the value of the products of street railroad repair shops.

Products.—Table 15 shows the number and value of all street cars manufactured, as reported at the census of 1905, distributed according to character of establishments and kind of cars. With respect to this information no effort previous to the present census has been made to obtain complete data, so that no comparative figures are available.

TABLE 15.—*Number, kind, and value of street railroad cars built by all establishments: 1905.*

	Number.	Value.
Total	4,694	$9,902,310
In street car manufacturing establishments	3,966	8,302,512
In street railroad repair shops	310	605,144
In steam car manufacturing establishments	418	994,654
Kind:		
Electric—		
Closed [1]	3,217	7,233,534
Combination	517	1,289,028
Open	562	867,368
Other	356	479,693
Horse	42	32,687

[1] Includes 288 cars, valued at $580,669, enumerated only as "passenger cars."

At the census of 1905, 4,694 street cars were produced, of which 3,966, or 84.5 per cent, were built in establishments devoted primarily to the construction of street cars. Only 310 cars, or 6.6 per cent of the total number produced, were built in street railroad repair shops, which was 108 cars less than the number constructed in establishments engaged primarily in the production of steam railroad cars.

The value of the cars manufactured during the census year in street car manufacturing establishments and in street railroad repair shops was $8,907,656, which constituted only 36.7 per cent of the aggregate value of the products of the combined industries. Thus the value of the new cars built amounted to about one-third, and the value of the repair work to about two-thirds, of the combined value of products of the two industries which build and keep in repair the rolling stock of street railroads. The value of street cars manufactured in establishments devoted to their construction was $8,302,512, or 76.5 per cent of the value of products of this branch of the combined industries; while in the case of the repair shops the value of the cars produced, $605,144, formed only 4.5 per cent of the total value of products.

The average value per car of all cars built during the census year was $2,110. Of the three classes, as distinguished in the table, of establishments producing street cars, the lowest average value per car resulted from the building operations of the railroad repair shops, and the cars of the greatest average value were constructed by establishments producing primarily steam railroad cars. The low average value of the cars built in street railroad repair shops was caused by the fact that a large number were freight and work cars constructed in many cases of old trucks and other portions of passenger cars which had been condemned for passenger traffic. Moreover, many of the passenger cars reported as built were old passenger cars reconstructed and newly equipped with up to date motors and brakes. It is natural, therefore, that the average value per car should be less than that for the other two classes of establishments shown in the table which produced for the most part new work.

Since 1900 considerable improvement in the rolling stock of street railroads has taken place. In general the size of cars has been increased and they have been made more comfortable and more suitable to the demands of a rapidly increasing traveling public. On the interurban lines, which are usually in direct competition with the steam railroads, it is essential that the comfort of the car should approach as nearly as possible that of the steam railroad coach. It follows that each year more costly cars are being produced by the street car manufacturers. Evidence of the fact can be found in the reports of 3 large establishments that at the census of 1900 reported 1,603 cars built during the census year with an average value of $1,387, while the same 3 companies at the census of 1905 reported the construction of 1,597 cars during the census year with an average value per car of $2,393.

Further evidence of the progressive changes in this respect which have taken place since 1900 is obtainable from a comparison of the number and value of street cars produced during that census year by establishments engaged primarily in the manufacture of steam railroad cars, with the number and value of the cars produced by the same class of establishments at the present census. According to the special report on cars, steam railroad, for 1900, 935 street railroad

cars of an average value of $1,167 were finished during the census year by manufacturers of steam railroad cars, while for 1905 this class of establishments reported the construction of 418 cars with an average value of $2,380.

Table 15 shows that practically all the cars produced were for electrified street railroads. No cable cars were reported and only 42 for horsepower. Over two-thirds of the electric cars turned out were closed cars. The perfection of the combination car, namely, a car which is devoted in part to freight and in part to passenger traffic, is a matter of comparatively recent date, but now they are much used on the interurban lines of the middle West, and during the census year nearly as many cars of this character as open cars were built. The average value of the combination car was $2,493, or $244 more than that of the closed, and $950 more than that of the open cars.

STREET RAILROAD REPAIR SHOPS.

Table 16 is a summary of the statistics of the street railroad repair shops, distributed according to geographic divisions.

TABLE 16.—STREET RAILROAD REPAIR SHOPS—SUMMARY, BY GEOGRAPHIC DIVISIONS: 1905.

DIVISION.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products.
			Number.	Salaries.	Average number.	Wages.			
United States	86	$12,905,853	499	$542,687	11,052	$7,012,798	$418,276	$5,463,360	$13,437,121
North Atlantic[1]	37	8,017,711	242	248,978	6,372	3,926,403	231,257	2,775,103	7,181,741
South Atlantic[2]	5	278,942	23	21,667	240	119,895	6,782	124,932	273,276
North Central[3]	31	3,921,481	119	151,107	3,077	1,944,808	162,549	1,767,383	4,025,847
South Central[4]	4	117,050	6	6,449	124	63,560	5,438	71,743	147,190
Western[5]	9	570,669	109	114,486	1,239	958,132	12,250	724,199	1,809,067

[1] Includes Maine, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania.
[2] Includes Delaware, District of Columbia, Virginia.
[3] Includes Ohio, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, Nebraska, Kansas.
[4] Includes Kentucky, Texas.
[5] Includes Colorado, Utah, Washington, Oregon, California.

The number of repair shops in each division is indicative of the development of the street railroad in the different sections of the country. It is natural that the North Atlantic division, embracing states for the most part far more densely settled than those of the other divisions, should exceed them in every statistical item shown in the table. The second division in this respect was the North Central, which had 31 establishments, as compared with 37 in the North Atlantic division; but the latter gave employment to twice as many wage-earners as the former and accomplished construction and repair work valued at nearly twice as many dollars. Thus, while the North Central reported nearly as many establishments as the leading division, yet when measured by the average number of wage-earners employed and the value of product, the operations of the average establishment in the North Atlantic division were nearly twice as extensive as those of the average establishment of the North Central division.

Tables 17 and 18 show statistics in detail for cars, street railroad, not including operations of railroad companies, and cars and general shop construction and repairs by street railroad companies, respectively, distributed according to states, as far as it is possible to show the states separately without disclosing the operations of single establishments.

TABLE 17.—CARS, STREET RAILROAD, NOT INCLUDING OPERATIONS OF RAILROAD COMPANIES—DETAILED SUMMARY, BY STATES: 1905.

	United States.	Ohio.	All other states.[1]
Number of establishments	14	4	10
Capital, total	$12,975,703	$1,748,065	$11,227,638
Land	$972,804	$61,294	$911,510
Buildings	$1,823,271	$297,942	$1,525,329
Machinery, tools, and implements	$1,912,299	$318,322	$1,593,977
Cash and sundries	$8,267,329	$1,070,507	$7,196,822
Proprietors and firm members	3	....	3
Salaried officials, clerks, etc.:			
Total number	264	70	194
Total salaries	$398,246	$92,609	$305,637
Officers of corporations—			
Number	29	9	20
Salaries	$119,915	$26,000	$93,915
General superintendents, managers, clerks, etc.—			
Total number	235	61	174
Total salaries	$278,331	$66,609	$211,722
Men—			
Number	214	53	161
Salaries	$268,525	$63,435	$205,090
Women—			
Number	21	8	13
Salaries	$9,806	$3,174	$6,632
Wage-earners, including pieceworkers, and total wages:			
Greatest number employed at any one time during the year	6,175	1,089	5,086
Least number employed at any one time during the year	2,992	502	2,490
Average number	4,730	765	3,965
Total wages	$2,839,579	$474,738	$2,364,841
Men 16 years and over—			
Average number	4,667	764	3,903
Wages	$2,823,966	$474,438	$2,349,528
Women 16 years and over—			
Average number	9	....	9
Wages	$4,619	....	$4,619
Children under 16 years—			
Average number	54	1	53
Wages	$10,994	$300	$10,694
Average number of wage-earners, including pieceworkers, employed during each month:			
Men 16 years and over—			
January	5,313	905	4,408
February	5,218	824	4,394
March	4,928	784	4,144
April	5,028	768	4,260
May	5,080	742	4,338
June	5,044	718	4,326
July	4,916	807	4,109
August	4,711	819	3,892
September	4,523	925	3,598
October	4,171	825	3,346
November	3,713	555	3,158
December	3,359	496	2,863
Women 16 years and over—			
January	11	....	11
February	11	....	11
March	11	....	11
April	9	....	9
May	9	....	9
June	9	....	9
July	8	....	8
August	8	....	8
September	7	....	7
October	7	....	7
November	8	....	8
December	10	....	10
Children under 16 years—			
January	70	1	69
February	68	1	67
March	66	1	65
April	66	1	65
May	61	1	60
June	56	1	55
July	49	1	48

	United States.	Ohio.	All other states.
Average number of wage-earners, including pieceworkers, employed during each month—Continued.			
Children under 16 years—Continued.			
August	48	1	47
September	42	1	41
October	42	1	41
November	40	1	39
December	40	1	39
Miscellaneous expenses, total	$980,970	$133,579	$847,391
Rent of works	$7,300	$1,300	$6,000
Taxes	$32,877	$7,229	$25,648
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$940,793	$125,050	$815,743
Materials used, total cost	$5,341,444	$1,069,383	$4,272,061
Principal materials	$3,327,061	$1,026,868	$2,300,193
Fuel	$130,767	$23,988	$106,779
Rent of power and heat	$2,150	....	$2,150
Mill supplies	$34,650	$11,464	$23,186
All other materials	$1,741,012	$5,527	$1,735,485
Freight	$105,804	$1,536	$104,268
Products, total value	$10,844,196	$1,828,326	$9,015,870
Street railroad cars—			
Electric—			
Closed—			
Number	2,621	485	2,136
Value	$5,777,257	$1,135,595	$4,641,662
Combination—			
Number	502	22	480
Value	$1,240,864	$137,406	$1,103,458
Open—			
Number	554	102	452
Value	$860,349	$240,182	$620,167
Other—			
Number	251	96	155
Value	$394,860	$271,492	$123,368
Horse—			
Number	38	10	28
Value	$29,182	$11,448	$17,734
Steam railroad cars—			
Freight service—			
Box—			
Number	68	....	68
Value	$31,515	....	$31,515
Flat—			
Number	35	....	35
Value	$13,688	....	$13,688
Gondola or ore—			
Number	3	....	3
Value	$690	....	$690
Refrigerator—			
Number	2	....	2
Value	$2,250	....	$2,250
Stock—			
Number	16	....	16
Value	$9,965	....	$9,965
Other—			
Number	12	....	12
Value	$1,555	....	$1,555
All other products	$2,482,021	$32,203	$2,449,818
Power:			
Number of establishments reporting	14	4	10
Total horsepower	9,763	2,375	7,388
Owned—			
Engines—			
Steam—			
Number	35	8	27
Horsepower	6,775	1,850	4,925
Electric motors—			
Number	157	6	151
Horsepower	2,709	525	2,184
Other power, horsepower	50	....	50
Rented—			
Electric motors—			
Number	11	....	11
Horsepower	229	....	229

[1] Includes establishments distributed as follows: California, 2; Colorado, 1; Missouri, 2; New Jersey, 1, New York, 2; North Carolina, 1; Pennsylvania, 1.

TABLE 18.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY

		United States.[1]	California.	Illinois.	Iowa.	Kentucky.
1	Number of establishments	86	3	10	3	3
2	Capital, total	$12,905,853	$144,146	$1,081,939	$192,892	$94,050
3	Land	$3,168,685	$35,000	$193,448	$10,000	$22,750
4	Buildings	$5,836,686	$55,000	$605,589	$31,000	$48,600
5	Machinery, tools, and implements	$2,151,221	$46,646	$204,602	$36,251	$17,600
6	Cash and sundries	$1,749,261	$7,500	$78,300	$115,641	$5,100
	Salaried officials, clerks, etc.:					
7	Total number	499	91	29	5	6
8	Total salaries	$542,687	$93,841	$31,107	$5,340	$6,449
	Officers of corporations—					
9	Number	25	1	2		2
10	Salaries	$45,566	$100	$2,700		$2,220
	General superintendents, managers, clerks, etc.—					
11	Total number	474	90	27	5	4
12	Total salaries	$497,121	$93,741	$28,407	$5,340	$4,229
	Men—					
13	Number	468	90	27	5	4
14	Salaries	$493,923	$93,741	$28,407	$5,340	$4,229
	Women—					
15	Number	6				
16	Salaries	$3,198				
	Wage-earners, including pieceworkers, and total wages:					
17	Greatest number employed at any one time during the year	12,576	941	1,131	150	132
18	Least number employed at any one time during the year	9,477	718	852	99	95
19	Average number	11,052	852	1,006	120	103
20	Total wages	$7,012,798	$671,866	$654,486	$64,073	$48,560
	Men 16 years and over—					
21	Average number	11,009	852	1,003	120	102
22	Total wages	$6,995,067	$671,866	$653,286	$64,073	$48,267
	Women 16 years and over—					
23	Average number	38		3		
24	Wages	$16,722		$1,200		
	Children under 16 years—					
25	Average number	5				1
26	Wages	$1,009				$293
	Average number of wage-earners, including pieceworkers, employed during each month:					
	Men 16 years and over—					
27	January	10,720	796	975	129	100
28	February	11,017	853	1,036	130	103
29	March	11,142	797	1,057	123	101
30	April	11,418	846	1,089	126	99
31	May	11,294	854	1,074	124	100
32	June	11,259	860	1,064	111	97
33	July	10,533	854	968	113	106
34	August	10,815	893	1,016	111	104
35	September	10,990	908	1,013	100	103
36	October	11,206	926	964	132	103
37	November	11,072	869	908	119	104
38	December	10,642	768	872	122	104
	Women 16 years and over—					
39	January	38		3		
40	February	38		3		
41	March	38		3		
42	April	40		3		
43	May	40		3		
44	June	40		3		
45	July	36		3		
46	August	38		3		
47	September	39		3		
48	October	36		3		
49	November	36		3		
50	December	37		3		
	Children under 16 years—					
51	January	4				1
52	February	5				1
53	March	5				1
54	April	5				1
55	May	5				1
56	June	6				1
57	July	5				1
58	August	5				1
59	September	5				1
60	October	5				1
61	November	5				1
62	December	5				1
63	Miscellaneous expenses, total	$418,276	$1,635	$39,424	$6,062	$5,438
64	Rent of works	$4,296		$1,800		
65	Taxes	$115,302	$585	$20,974	$2,917	$1,570
66	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$285,483	$1,050	$16,650	$3,145	$3,868
67	Contract work	$13,195				
68	Materials used, total cost	$5,463,360	$461,101	$417,545	$74,932	$63,493
69	Principal materials	$5,040,911	$415,784	$370,076	$41,139	$52,788
70	Fuel	$153,208	$10,446	$23,415	$25	$275
71	Rent of power and heat	$10,154	$2,645	$300		$200
72	Mill supplies	$45,931	$1,855	$11,756	$364	$120
73	All other materials	$209,816	$30,371	$11,798	$33,404	$10,250
74	Freight	$3,340		$200		
75	Products, aggregate value of all shopwork	$13,437,121	$1,228,443	$1,142,562	$150,407	$123,940
76	Motive power and machinery department, total value	$510,946				
77	Work for other corporations	$2,626				
78	All other products	$508,320				
79	Car department, total value[2]	$12,581,365	$1,228,443	$1,068,380	$150,407	$123,940
	Cars built—					
	Passenger—					
80	Number	288				
81	Value	$580,669				
	Freight—					
82	Number	13				
83	Value	$11,366				
	Other—					
84	Number	9				
85	Value	$13,109				
86	Passenger and freight cars repaired	$11,254,505	$1,221,869	$887,091	$92,146	$94,193
87	Work for other corporations	$36,714				
88	All other products	$685,002		$120,073		

[1] Includes establishments distributed as follows: Colorado, 2; Connecticut, 2; Delaware, 1; District of Columbia, 2; Kansas, 1; Maine, 2; Minnesota, 2; Nebraska, 1; Oregon, 1; Texas, 1; Utah, 1; Virginia, 2; Washington, 2; Wisconsin, 1.

STREET RAILROAD COMPANIES—DETAILED SUMMARY, BY STATES: 1905.

Massachusetts.	Michigan.	Missouri.	New Jersey.	New York.	Ohio.	Pennsylvania.	All other states.[1]	
[illegible]	[illegible]	[illegible]	[illegible]	14	5	9	21	1
$1,092,996	$526,654	$1,390,781	$668,850	$4,974,948	$127,825	$1,163,709	$1,447,063	2
$253,835	$144,000	$272,843	$66,400	$1,483,037	$26,400	$346,000	$314,972	3
$495,055	$134,000	$612,991	$124,000	$2,660,467	$65,200	$430,100	$574,684	4
$142,751	$175,640	$326,145	$306,700	$391,450	$13,700	$251,026	$238,710	5
$201,355	$73,014	$178,802	$171,750	$439,994	$22,525	$136,583	$318,697	6
2	14	28	20	169	19	44	72	7
$2,580	$18,593	$43,877	$26,309	$167,732	$16,678	$44,867	$85,314	8
1	...	[illegible]	...	...	5	7	1	9
$1,500	...	$19,400	...	...	$2,286	$6,360	$11,000	10
1	14	22	20	169	14	37	71	11
$1,080	$18,593	$24,477	$26,309	$167,732	$14,392	$38,507	$74,314	12
1	14	22	20	165	14	36	70	13
$1,080	$18,593	$24,477	$26,309	$165,284	$14,392	$38,457	$73,614	14
...	...	...	...	4	...	1	1	15
...	...	...	...	$2,448	...	$50	$700	16
[illegible]	460	1,071	446	4,431	165	1,230	1,459	17
847	335	801	284	3,012	135	1,110	1,189	18
903	424	935	356	3,710	150	1,176	1,317	19
$602,384	$245,804	$602,774	$224,878	$2,260,615	$93,788	$687,088	$856,482	20
[illegible]	424	934	356	3,690	150	1,175	1,315	21
$596,222	$245,804	$602,589	$224,878	$2,251,255	$93,788	$686,698	$856,341	22
15	...	...	...	20	...	...	...	23
$6,162	...	...	...	$9,360	...	...	...	24
...	...	1	...	...	...	1	2	25
...	...	$185	...	...	...	$390	$141	26
887	435	925	285	3,634	156	1,134	1,264	27
888	445	972	310	3,721	144	1,130	1,285	28
899	437	1,000	345	3,739	159	1,161	1,324	29
879	445	1,040	363	3,899	150	1,160	1,322	30
870	439	997	359	3,844	151	1,174	1,308	31
[illegible]	429	957	319	3,879	146	1,187	1,325	32
906	428	919	314	3,316	144	1,183	1,282	33
878	346	928	408	3,462	150	1,201	1,318	34
873	420	901	443	3,531	153	1,205	1,340	35
896	432	881	415	3,742	151	1,190	1,374	36
899	424	854	393	3,826	148	1,188	1,340	37
896	408	834	318	3,687	148	1,187	1,298	38
15	...	...	...	20	...	...	...	39
15	...	...	...	20	...	...	...	40
15	...	...	...	20	...	...	...	41
17	...	...	...	20	...	...	...	42
17	...	...	...	20	...	...	...	43
17	...	...	...	20	...	...	...	44
13	...	...	...	20	...	...	...	45
15	...	...	...	20	...	...	...	46
16	...	...	...	20	...	...	...	47
13	...	...	...	20	...	...	...	48
13	...	...	...	20	...	...	...	49
14	...	...	...	20	...	...	...	50
...	...	1	...	...	...	1	1	51
...	...	1	...	...	...	1	2	52
...	...	1	...	...	...	1	2	53
...	...	1	...	...	...	1	2	54
...	...	1	...	...	...	1	2	55
...	...	1	...	...	...	1	[illegible]	56
...	...	1	...	...	...	1	2	57
...	...	1	...	...	...	1	2	58
...	...	1	...	...	...	1	2	59
...	...	1	...	...	...	1	2	60
...	...	1	...	...	...	1	[illegible]	61
...	...	1	...	...	...	1	2	62
$4,765	$10,102	$74,352	$26,076	$153,681	$6,956	$43,625	$46,160	63
...	...	...		$1,200	$1,296	...	...	64
$1,030	$2,013	$18,619	$3,855	$38,831	$2,725	$8,200	$13,983	65
$3,735	$8,089	$55,733	$19,121	$103,555	$2,935	$35,425	$32,177	66
...	...	...	$3,100	$10,095	...	...	...	67
$383,705	$313,022	$489,958	$469,592	$1,297,905	$54,949	$482,962	$954,196	68
$367,194	$295,510	$452,343	$462,706	$1,208,941	$43,390	$465,292	$865,748	69
$7,224	$3,900	$12,825	$468	$70,435	$2,052	$4,773	$17,370	70
...	$1,111	...	$4,383	$1,080	...	...	$575	71
$1,784	$4,320	$5,636	$1,135	$3,423	$5,573	$4,936	$5,029	72
$7,503	$8,181	$19,154	$900	$14,026	$3,934	$7,961	$62,334	73
...	...	...	...	...	...	...	$3,140	74
$993,434	$587,521	$1,210,961	$746,855	$3,879,933	$172,371	$1,258,542	$1,942 152	75
$11,313	$3,688	$386,881	...	$8,277	...	$27,490	$73,297	76
$2,626	...	...	...	...	...	...	...	77
$8,687	$3,688	$386,881	...	$8,277	...	$27,490	$73 297	78
$982,121	$564,121	$824,080	$746,855	$3,642,970	$172,371	$1,231,052	$1,846,625	79
...	...	...	...	...	...	...	[3] 288	80
...	...	...	...	...	...	...	[3] $580,669	81
...	...	...	...	...	...	...	[3] 13	82
...	...	...	...	...	...	...	[3] $11,365	83
...	...	...	...	...	...	...	[3] 9	84
...	...	...	...	...	...	...	[3] $13,109	85
$613,099	$554,629	$816,080	$746,855	$3,417,294	$158,089	$1,224,397	$1,428,763	86
$8,607	...	...	...	...	...	...	$28,107	87
$296,041	...	...	...	$222,030	$14,282	$1,101	$31,475	88

[2] The number and value of cars can not be shown in detail by states.

[3] Represents products of all states.

TABLE 18.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY

		United States.	California.	Illinois.	Iowa.	Kentucky.
	Products—Continued.					
89	Bridge and building department (shopwork), total value	$327,855		$74,182		
90	Repairs and renewals	$253,133				
91	All other products	$74,722		$74,182		
92	All other products not classified	$16,955				
	Power:					
93	Number of establishments reporting	75	3	9	2	3
94	Total horsepower	12,353	475	1,585	115	370
	Owned—					
	Engines—					
	Steam—					
95	Number	17	2	2		
96	Horsepower	1,355	50	400		
	Gas and gasoline—					
97	Number	1				
98	Horsepower	40				
	Water wheels—					
99	Number	6				
100	Horsepower	600				
	Electric motors—					
101	Number	360	12	25	4	8
102	Horsepower	9,199	240	1,173	115	370
	Rented—					
	Electric motors—					
103	Number	52	11	2		
104	Horsepower	1,159	185	12		

STREET RAILROAD COMPANIES—DETAILED SUMMARY, BY STATES: 1905—Continued.

Massachusetts.	Michigan.	Missouri.	New Jersey.	New York.	Ohio.	Pennsylvania.	All other states.	
...	$19,712	...	...	$228,686	...	...	$5,275	89
...	$19,712	...	...	$228,686	...	...	$4,735	90
...	...	...	...	...	...	...	$540	91
...	...	...	...	...	...	...	$16,955	92
5	3	4	3	12	4	6	21	93
430	245	1,720	445	3,200	169	1,744	1,855	94
...	1	...	...	7	1	...	4	95
...	50	...	...	485	20	...	350	96
...	...	...	...	...	...	1	...	97
...	...	...	...	...	...	40	...	98
...	...	...	...	6	...	...	...	99
...	...	...	...	600	...	...	...	100
23	4	57	...	78	9	94	46	101
430	20	1,720	...	2,030	149	1,704	1,248	102
...	12	...	12	4	...	...	11	103
...	175	...	445	85	...	...	257	104

CHEMICALS AND ALLIED PRODUCTS

CHEMICALS AND ALLIED PRODUCTS.

By CHARLES E. MUNROE, Professor of Chemistry, George Washington University, Expert Special Agent.

SCOPE OF THE CENSUS.

The first special report on the manufacture of chemicals was made at the census of 1880 under the caption "chemical production." At each subsequent census a special report on this topic has been made under the caption "chemicals and allied products." Inspection of these reports shows that the industries included have varied considerably, though each report has embraced the industries producing acids, sodas, potashes, alums, glycerin, dyestuffs and extracts, explosives, fertilizers, pigments, wood distillation products, salts, and certain elementary substances, such as bromine and phosphorus. The special report at the census of 1880 also embraced the industries producing soap, candles, castor oil, glucose, and sulphur, the products of which had a total value of $28,010,152. These latter industries did not appear in the special report of 1890, but those producing pharmaceutical preparations, ready mixed paints, and varnishes and japans were added, the pharmaceutical preparations having a value of $16,744,643. All the industries embraced in the special report for 1890 were included in the special report for 1900 and in the present report, with the exception of pharmaceutical preparations, while those producing essential oils and bone, ivory, and lamp black were added, these latter industries reporting in 1900 products valued at $1,173,282, and in 1905 products valued at $2,112,379. The manufactures included under any industry may, however, differ somewhat from census to census as new products of the same general character are put upon the market or older ones cease to be used. The returns in the establishments enumerated were classified according to that class of product which had the maximum value, as is the rule in all Census classification, but many of these establishments produced also subsidiary products of less value, which, had they been returned as principal products, would have placed these establishments in other classes. Such subsidiary products appear in the tabular summaries of the Census reports under the heading "all other products," but in some cases they are also treated of in the text and in the minor tables of their special classes.

A reason for the variation in the industries included at the different censuses is found in the very general and indefinite title used, for in the strictest technical sense every material thing is a chemical, and accordingly every industry in which the materials used undergo a chemical change in the process of manufacture, as in the smelting of iron from its ores or the production of leather from a hide, may be considered as a chemical industry. It is evident that if this view of the significance of the title were taken, "chemicals and allied products" would properly cover every manufacture except those like furniture making, machine construction, or textiles, in which the material remains unchanged in composition during the manufacture but is turned, or cast, or woven into other shapes. The popular idea of the term limits its application but admits as chemical industries the manufacture of gunpowder, fertilizers, and similar mixtures, whose ingredients undergo no chemical change during the process of compounding the mixtures. It thus becomes necessary to decide arbitrarily upon the industries to be included. Those so included at the census of 1905 may be divided into the following classes:

I. A. Sulphuric, nitric, and mixed acids.
I. B. Other acids.
II. Sodas.
III. Potashes.
IV. Alums.
V. Coal tar products.
VI. Cyanides.
VII. Wood distillation.
VIII. Fertilizers.
IX. Bleaching materials.
X. Chemicals produced by the aid of electricity.
XI. Dyestuffs.
XII. Tanning materials.
XIII. Paints and varnishes.
XIV. Explosives.
XV. Plastics.
XVI. Essential oils.
XVII. Compressed and liquefied gases.
XVIII. Fine chemicals.
XIX. General chemicals.

This classification is precisely that followed at the census of 1900, except that Class I is at the present census subdivided into Subclasses A and B, and pre-

cisely the same industries are included in each case. From the list given it is apparent that "chemicals and allied products" includes twenty distinct industries. As a matter of fact, the number is very much greater. This becomes evident when it is recalled that nitric acid differs from sulphuric acid as greatly as paper from leather, and that the processes used in the manufacture of the two acids differ as much as do those used in making paper and leather.

TABLE 1.—*Chemicals and allied products—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	1,786	1,691	95	5.6
Capital	$323,997,131	$238,471,290	$85,525,841	35.9
Salaried officials, clerks, etc., number	11,147	8,602	2,545	29.6
Salaries	$15,014,018	$11,339,595	$3,674,423	32.4
Wage-earners, average number	59,198	46,700	12,498	26.8
Total wages	$29,515,863	$21,783,335	$7,732,528	35.5
Men 16 years and over	56,678	44,574	12,104	27.2
Wages	$28,834,403	$21,198,520	$7,635,883	36.0
Women 16 years and over	2,362	1,949	413	21.2
Wages	$649,296	$554,128	$95,168	17.2
Children under 16 years	158	177	[1] 19	[1] 10.7
Wages	$32,164	$30,687	$1,477	4.6
Miscellaneous expenses	$26,258,768	$14,822,853	$11,435,915	77.2
Cost of materials used	$176,400,680	$124,018,044	$52,382,636	42.2
Value of products	$282,169,216	$202,506,076	$79,663,140	39.3

[1] Decrease.

Because of the variation in the industries included at the successive censuses, only a partial comparison of the data can be made, except for the censuses of 1900 and 1905, when the industries included were identical. The general statistics for the establishments actively engaged in the manufacture of chemicals and allied products in 1900 and 1905, together with the amount and per cent of increase in each item for this period, are set forth in Table 1.

The term "capital" as used in the Census reports refers only to the sum invested in lands, buildings, machinery, and tools and implements, and the funds required to carry on the business, and does not include capital stock.

Table 1 shows an increase for 1905 over 1900 in every item except the number of children employed. It is particularly to be noted that though the number of children employed was reduced by 19, the wages paid them increased by $1,477. The data given in this table indicate a most flourishing condition for the industry as a whole. A clearer idea would be gained of the economic conditions that existed if a separate presentation were made of each industry included in this class. This is not feasible at this point, but the data may, as in 1900, be divided for comparison among six subclasses which are popularly regarded as separate industries. Table 2 presents a comparative summary of these subclasses.

TABLE 2.—COMPARATIVE SUMMARY, BY INDUSTRIES: 1905 AND 1900.

	CHEMICALS.[1]		DYESTUFFS AND EXTRACTS.		ESSENTIAL OILS.		EXPLOSIVES.		FERTILIZERS.		PAINTS AND VARNISHES.[2]	
	1905	1900	1905	1900	1905	1900	1905	1900	1905	1900	1905	1900
Number of establishments	448	433	98	77	52	47	124	97	400	422	664	615
Capital	$119,890,193	$89,069,450	$14,904,150	$7,839,034	$723,004	$576,286	$42,307,163	$19,465,846	$69,023,264	$60,685,753	$77,149,357	$60,834,921
Salaried officials, clerks, etc., number	3,387	2,123	361	229	37	39	1,289	768	1,618	1,712	4,455	3,731
Salaries	$4,901,523	$2,923,033	$608,790	$312,109	$40,002	$24,733	$1,797,050	$914,447	$1,940,712	$2,124,972	$5,725,941	$5,040,301
Wage-earners, average number	24,525	19,020	2,707	1,647	132	168	5,800	4,502	14,201	11,581	11,833	9,782
Total wages	$13,361,972	$9,393,236	$1,264,492	$787,942	$69,711	$61,415	$3,308,774	$2,383,756	$5,142,147	$4,185,289	$6,368,767	$4,971,697
Men 16 years and over	23,366	18,101	2,678	1,607	127	161	5,708	4,349	14,065	11,435	10,734	8,921
Wages	$13,053,704	$9,133,868	$1,256,946	$781,370	$68,370	$59,576	$3,283,729	$2,346,887	$5,113,232	$4,142,853	$6,058,422	$4,733,966
Women 16 years and over	1,082	853	25	35	5	7	91	117	110	131	1,049	806
Wages	$291,269	$247,716	$6,966	$5,911	$1,341	$1,839	$24,945	$30,781	$25,446	$39,463	$299,329	$228,418
Children under 16 years	77	66	4	5	....	....	1	36	26	15	50	55
Wages	$16,999	$11,652	$580	$661	....	....	$100	$6,088	$3,469	$2,973	$11,016	$9,313
Miscellaneous expenses	$8,937,242	$4,362,608	$944,360	$458,212	$78,886	$48,763	$1,657,665	$1,096,604	$4,919,824	$3,734,285	$9,720,791	$5,122,381
Cost of materials used	$51,883,219	$34,545,862	$6,829,340	$4,745,912	$1,110,470	$588,594	$17,203,667	$10,334,974	$39,343,914	$28,958,473	$60,030,070	$44,844,229
Value of products	$92,088,378	$62,637,008	$10,893,113	$7,350,748	$1,464,662	$813,495	$29,602,884	$17,125,418	$56,632,853	$44,657,385	$91,487,326	$69,922,022

[1] Includes sulphuric, nitric, and mixed acids, and wood distillation.

[2] Includes bone, ivory, and lamp black.

At each census chemicals ranked first in capital, number of wage-earners employed, and total wages paid, being followed at each census by paints and varnishes, fertilizers, explosives, dyestuffs and extracts, and essential oils in the order named. At each census paints and varnishes ranked first in number of salaried officials, clerks, etc., salaries, miscellaneous expenses, and cost of materials used, with chemicals second, and the other industries in the order given above. Paints and varnishes ranked first in value of products, and chemicals second at the census of 1900, but this order was reversed at the census of 1905.

TABLE 3.—INCREASE AND PER CENT OF INCREASE IN THE SEPARATE INDUSTRIES: 1900 TO 1905.

	CHEMICALS.		DYESTUFFS AND EXTRACTS.		ESSENTIAL OILS.		EXPLOSIVES.		FERTILIZERS.		PAINTS AND VARNISHES.	
	Increase.	Per cent of increase.	Increase.	Per cent of increase.	Increase.	Per cent of increase.	Increase.	Per cent of increase.	Increase.	Per cent of increase.	Increase.	Per cent of increase.
Number of establishments	15	3.5	21	27.3	5	10.6	27	27.8	[1]22	[1]5.2	49	7.8
Capital	$30,820,743	34.6	$7,065,116	90.1	$146,718	25.5	$22,841,317	117.3	$8,337,511	13.7	$16,314,426	26.8
Salaried officials, clerks, etc., number	1,264	59.5	132	57.6	[1]2	[1]5.1	521	67.8	[1]94	[1]5.5	724	19.4
Salaries	$1,978,490	67.7	$296,681	95.1	$15,269	61.7	$882,603	96.5	[1]$184,260	[1]8.7	$685,640	13.6
Wage-earners, average number	5,505	22.4	1,060	64.3	[1]36	[1]21.4	1,298	28.8	2,620	22.6	2,051	21.0
Total wages	$3,968,736	42.3	$476,550	60.5	$8,296	13.5	$925,018	38.8	$956,858	22.9	$1,397,070	28.1
Men 16 years and over	5,265	29.1	1,071	66.6	[1]34	[1]21.1	1,359	31.2	2,630	23.0	1,813	20.3
Wages	$3,919,836	42.9	$475,576	60.9	$8,794	14.8	$936,842	39.9	$970,379	23.4	$1,324,456	28.0
Women 16 years and over	229	26.8	[1]10	[1]30.6	[1]2	[1]28.6	[1]26	[1]22.2	[1]21	[1]16.0	243	30.1
Wages	$43,553	17.6	$1,055	17.8	[1]$498	[1]27.1	[1]$5,836	[1]19.0	[1]$14,017	[1]35.5	$70,911	31.0
Children under 16 years	11	16.7	[1]1	[1]20.0	([2])	....	[1]35	[1]97.2	11	73.3	[1]5	[1]9.1
Wages	$5,347	45.9	[1]$81	[1]12.3	([2])	....	[1]$5,988	[1]98.4	$496	16.7	$1,703	18.3
Miscellaneous expenses	$4,574,634	104.9	$486,148	106.1	$30,123	61.8	$561,061	51.2	$1,185,539	31.7	$4,598,410	89.8
Cost of materials used	$17,337,357	50.2	$2,083,428	43.9	$521,876	88.7	$6,868,693	66.5	$10,385,441	35.9	$15,185,841	33.9
Value of products	$29,451,370	47.0	$3,542,365	48.2	$651,167	80.0	$12,477,466	72.9	$11,975,468	26.8	$21,565,304	30.8

[1] Decrease. [2] None reported in 1905.

In but one industry—chemicals—was there an increase in every item. The number of establishments increased in every industry except fertilizers, which showed a loss of 22. In each of the six industries there was a gain in capital, wages, miscellaneous expenses, cost of materials, and value of products. In two industries, fertilizers and essential oils, the number of salaried officials, clerks, etc., decreased, though the amount paid in salaries declined only in the former. The absolute increases were greatest in chemicals for every item except number of establishments, numbers of women and children wage-earners, wages paid to women, and miscellaneous expenses, but the percentages of increase fluctuated markedly, explosives showing the greatest percentage of increase in number of establishments, capital, salaried officials, and salaries; dyestuffs and extracts the greatest for wage-earners, wages, and miscellaneous expenses; and essential oils the greatest for cost of materials and value of products.

Marked fluctuations are shown in the number of establishments in the different states and territories, the largest increase, 29 establishments, occurring in Georgia, and the greatest decrease, 21 establishments, in New York. Increases occurred in 25 states and territories, and decreases in 17 states and territories. Three states and territories, Alaska, Indian Territory, and Wyoming, appear for the first time at this census, while Arizona, which reported 1 establishment in 1900, did not return any in 1905. Considered by geographic divisions, the North Atlantic suffered a decrease of 26 establishments, the South Atlantic gained 59, the North Central 25, the South Central 21, and the Western 16 establishments. In 1900 establishments were reported from 40 different states and territories, and in 1905 from 42, there being at the latter census 8 states and territories, namely, 2 in the North Central, 2 in the South Central, and 4 in the Western division, from which no returns for establishments were received.

TABLE 4.—*Number of establishments, by states and territories, with increase and rank: 1905 and 1900.*

STATE OR TERRITORY.	ESTABLISHMENTS.		Increase.	RANK.	
	1905	1900		1905	1900
United States	1,786	1,691	95	....	....
Alabama	27	19	8	16	17
Alaska	1	....	1	39	....
Arizona	....	1	[1]1	....	39
California	63	53	10	8	10
Colorado	6	4	2	31	35
Connecticut	40	31	9	15	14
Delaware	13	15	[1]2	24	19
District of Columbia	3	8	[1]5	35	27
Florida	15	10	5	23	24
Georgia	75	46	29	7	11
Illinois	89	88	1	5	5
Indian Territory	1	....	1	39	....
Indiana	52	35	17	11	13
Iowa	6	8	[1]2	31	27
Kansas	10	5	5	26	31
Kentucky	21	18	3	20	18
Louisiana	12	10	2	25	24
Maine	9	13	[1]4	28	21
Maryland	58	63	[1]5	10	8
Massachusetts	77	83	[1]6	6	6
Michigan	52	55	[1]3	11	9
Minnesota	10	8	2	26	27
Mississippi	7	4	3	30	35
Missouri	47	39	8	13	12
Nebraska	4	5	[1]1	33	31
Nevada	3	4	[1]1	35	35
New Hampshire	1	1	....	39	39
New Jersey	144	160	[1]16	3	3
New York	264	285	[1]21	2	2
North Carolina	42	23	19	14	15
Ohio	128	137	[1]9	4	4
Oregon	4	5	[1]1	33	31
Pennsylvania	315	306	9	1	1
Rhode Island	17	12	5	22	22
South Carolina	26	22	4	17	16
Tennessee	22	14	8	19	20
Texas	3	7	[1]4	35	30
Vermont	3	5	[1]2	35	31
Virginia	62	64	[1]2	9	7
Washington	9	4	5	28	35
West Virginia	25	9	16	18	26
Wisconsin	19	12	7	21	22
Wyoming	1	....	1	39	....

[1] Decrease.

Notwithstanding considerable decreases in 3 of these states, Pennsylvania, New York, New Jersey, and Ohio occupied the first four places in rank, in the order named, at the census of 1905 as well as at that of 1900. Illinois occupied fifth place at both censuses, and Massachusetts sixth. Georgia advanced from eleventh to seventh place, and California from tenth to

eighth, while Virginia fell from seventh to ninth, Maryland from eighth to tenth, and Michigan from ninth to eleventh, a rank shared at this census with Indiana. The greatest advance in rank was made by West Virginia, which passed from twenty-fourth place in 1900 to seventeenth in 1905. The largest decline in rank was that of the District of Columbia, which dropped from twenty-fifth to thirtieth place.

TABLE 5.—QUANTITY AND COST OF MATERIALS USED, WITH AMOUNT AND PER CENT OF INCREASE, AND AVERAGE COST PER UNIT: 1905 AND 1900.

	CENSUS.		Increase.	Per cent of increase.	COST PER UNIT.	
	1905	1900			1905	1900
Materials used, total cost	$176,400,680	$124,018,044	$52,382,636	42.2		
Fish—						
Thousands	923,305	458,963	464,342	101.2		
Cost	$880,142	$183,542	$696,600	379.5	$0.95	$0.40
Gums	$4,328,624	$3,817,112	$511,512	13.4		
Kainit—						
Tons	190,493	54,700	135,793	248.3		
Cost	$1,891,073	$520,833	$1,370,240	263.1	$9.93	$9.52
Limestone—						
Tons	789,056	790,456	[1] 1,400	[1] 0.2		
Cost	$972,546	$717,910	$254,636	35.5	$1.23	$0.91
Phosphate rock—						
Tons	999,370	797,772	201,598	25.3		
Cost	$4,312,607	$3,620,262	$692,345	19.1	$4.32	$4.54
Pyrites—						
Tons	689,627	633,837	55,790	8.8		
Cost	$3,834,450	$3,101,075	$733,375	23.6	$5.56	$4.89
Wood for alcohol—						
Cords	586,144	495,073	91,071	18.4		
Cost	$1,783,004	$1,255,794	$527,210	42.0	$3.04	$2.54
Wood for extracts—						
Cords	258,981	211,040	47,941	22.7		
Cost	$795,786	$675,321	$120,465	17.8	$3.07	$3.20
Sulphuric acid—						
Tons	422,320	280,028	142,292	50.8		
Cost	$3,348,982	$1,946,742	$1,402,240	72.0	$7.93	$6.95
Nitric acid—						
Pounds	10,766,367	3,131,894	7,634,473	243.8		
Cost	$540,865	$154,144	$386,721	250.9	$0.05	$0.05
Mixed acids—						
Pounds	109,072,130	69,566,011	39,506,119	56.8		
Cost	$3,251,080	$1,560,133	$1,690,947	108.4	$0.03	$0.02
Acid phosphate—						
Tons	320,559	287,147	33,412	11.6		
Cost	$2,912,010	$2,182,316	$729,694	33.4	$9.08	$7.60
Argols	$2,013,400	$2,204,800	[1] $191,400	[1] 8.7		
Ammonia, aqua—						
Pounds	26,249,683	16,185,257	10,064,426	62.2		
Cost	$878,992	$547,040	$331,952	60.7	$0.03	$0.03
Ammonium sulphate—						
Tons	16,216	8,493	7,723	90.9		
Cost	$956,965	$657,726	$299,239	45.5	$59.01	$77.44
Alcohol, grain—						
Gallons	1,095,632	331,207	764,425	230.8		
Cost	$815,361	$510,375	$304,986	59.8	$0.74	$1.54
Alcohol, wood—						
Gallons	7,591,772	3,692,803	3,898,969	105.6		
Cost	$3,084,380	$1,751,345	$1,333,035	76.1	$0.41	$0.47
Bones, tankage, and offal	$5,398,329	$10,313,661	[1] $4,915,332	[1] 47.7		
Common salt—						
Tons	188,018	42,189	145,829	345.7		
Cost	$496,642	$142,398	$354,244	248.8	$2.64	$3.38
Cottonseed and cottonseed meal	$2,376,448	$167,410	$2,209,038	1,319.5		
Dry colors	$10,769,926	$9,476,333	$1,293,593	13.7		
Glycerin—						
Pounds	46,043,611	34,635,822	11,407,789	32.9		
Cost	$5,062,919	$3,419,406	$1,643,513	48.1	$0.11	$0.10
Lead—						
Tons	129,027	104,401	24,626	23.7		
Cost	$11,173,615	$8,618,097	$2,555,518	29.7	$86.60	$82.55
Lime—						
Bushels	6,191,318	7,428,885	[1] 1,237,567	[1] 16.7		
Cost	$761,937	$442,252	$319,685	72.3	$0.12	$0.06
Linseed oil—						
Gallons	20,407,104	16,157,117	4,249,987	26.3		
Cost	$7,869,270	$7,495,196	$374,074	5.0	$0.39	$0.46
Nitrate of potash—						
Tons	4,169	6,084	[1] 1,915	[1] 31.5		
Cost	$267,297	$300,199	[1] $32,902	[1] 11.0	$64.12	$49.34
Nitrate of soda—						
Tons	220,977	147,020	73,957	50.3		
Cost	$9,290,631	$4,899,622	$4,391,009	89.6	$42.04	$33.33
Potash salts	$4,237,313	$3,891,818	$345,495	8.9		
Sulphur—						
Tons	76,859	83,530	[1] 6,671	[1] 8.0		
Cost	$1,674,031	$1,724,857	[1] $50,826	[1] 3.0	$21.78	$20.65
Tallow and fat	$238,881	$380,517	[1] $141,636	[1] 37.2		
Wood ashes—						
Bushels	210,083	801,047	[1] 590,964	[1] 73.8		
Cost	$26,175	$39,507	[1] $13,332	[1] 33.8	$0.12	$0.05
All other components of products	$32,381,443	$24,497,258	$7,884,185	32.2		
Fuel	$7,560,710	$5,515,636	$2,045,074	37.1		
Mill supplies	$760,642	$779,814	[1] $19,172	[1] 2.5		
All other materials	$37,154,806	$13,066,053	$24,088,753	184.4		
Rent of power and heat	$773,672	$297,568	$476,104	160.0		
Freight	$1,525,726	$3,143,972	[1] $1,618,246	[1] 51.5		

[1] Decrease.

Unless otherwise specified, the ton mentioned in text and tables is the short ton of 2,000 pounds. It appears that in 1905 as compared with 1900 there was an increase in the quantity of each of the

materials reported as used in every case except for limestone, lime, nitrate of potash, sulphur, and wood ashes. For the cost of materials used, increases were reported in every item except bones, tankage, and offal, nitrate of potash, sulphur, tallow and fat, wood ashes, mill supplies, and freight, in which there was reported a decrease in total cost. The decrease in quantity and cost of nitrate of potash is more than offset by the increase in quantity and cost of nitrate of soda, which is a substitute for the former for the majority of uses and is much cheaper. The decrease in quantity and cost for sulphur is more than offset by the increase in quantity and cost of pyrites, which, as later shown, is a most satisfactory substitute for sulphur in the sulphuric acid industry. The decrease in quantity and cost of wood ashes, which are used as a source of potassium compounds, is more than offset by the increase in potash salts. Part of the decrease in wood ashes is, however, to be accounted for by the difference in the method of taking the census of 1905 from that of 1900, as this industry is largely a neighborhood industry. The decrease in bones, tankage, and offal, which are used as sources of nitrogen, phosphorus, and potassium in the compounding of fertilizers, is more than offset by the increases in fish, ammonium sulphate, cottonseed meal, and nitrate of soda, all of which supply nitrogen; in fish, phosphate rock, and acid phosphate, which supply phosphorus; and in potash salts, which supply potassium. The other decreases are not as well accounted for, but it is probable that the decreases in mill supplies and freight are to some extent offset by the increase of 264.2 per cent in "all other materials," while the cost of freight may also have been included in the cost returned for the various materials to a larger extent in 1905 than in 1900. No obvious explanation is at hand to account for the decrease in limestone and lime, but that in tallow and fat probably arose from the fact that soap, candles, etc., for which these materials are chiefly used, have become the product of maximum value in certain establishments, so as to carry them out of the classification of chemicals and allied products, under which they were included in 1900, and into another class.

The average cost per unit of quantity shows an increase for every item presented except phosphate rock, wood for extracts, aqua ammonia, ammonium sulphate, grain alcohol, wood alcohol, common salt, and linseed oil. It is surprising that there have not been more instances of decrease when it is considered that these averages take no account of grades and that there are wide variations in the quantities and values of the different grades of many of these articles. This is emphasized in the detailed study of sulphuric acid, given further on, when four different commercial grades, ranging in value from $7.11 to $27.20 per ton, are shown. It is probable that the decrease in the cost of wood for extracts was due to an increased use of a lower grade of wood. The decrease in the cost of aqua ammonia and ammonium sulphate is in entire harmony with the statistics set forth in Census Bulletin 65, on Coke, and results from the extension of the by-product coke industry and the greatly increased production, through this means, of ammonia liquor and ammonium sulphate. The decrease in the cost of wood alcohol follows a similar extension of the wood distillation industry, which is another by-product industry; while that in the cost of grain alcohol is due to the greatly increased use of tax-free alcohol in the manufacture of smokeless powder for the United States Government.

TABLE 6.—*Quantity and value of products, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Aggregate value	$282,178,216	$202,506,076	$79,672,140	39.3
Acids:				
Sulphuric—				
Tons	607,226	588,375	18,851	3.2
Value	$7,440,236	$7,305,444	$134,792	1.8
Nitric—				
Pounds	46,264,081	30,961,501	15,302,580	49.4
Value	$2,250,944	$1,454,909	$796,035	54.7
Mixed—				
Pounds	65,331,327	42,368,819	22,962,508	54.2
Value	$1,957,359	$1,111,158	$846,201	76.2
Tartaric—				
Pounds	2,684,000	2,677,004	6,996	0.3
Value	$680,280	$781,603	[1]$101,323	[1]13.0
Acetic—				
Pounds	27,001,322	26,660,565	340,757	1.3
Value	$537,542	$426,892	$110,650	25.9
All other	$6,606,743	$2,070,252	$4,536,491	219.1
Sodas:				
Sal soda—				
Tons	57,950	63,249	[1]5,299	[1]8.4
Value	$804,561	$779,443	$25,118	3.2
Soda ash—				
Tons	518,954	386,361	132,593	34.3
Value	$8,204,545	$4,768,383	$3,436,162	72.1
Bicarbonate—				
Tons	68,867	68,185	[illegible]	1.0
Value	$1,135,610	$1,324,843	[1]$189,233	[1]14.3
Caustic—				
Tons	80,173	78,779	1,394	1.8
Value	$2,924,850	$2,917,955	$6,895	0.2
Biborate (borax)—				
Tons	20,882	5,637	15,245	270.4
Value	$2,122,808	$502,480	$1,620,328	322.5
All other	$1,863,822	$1,344,947	$518,875	38.6
Alums:				
Pounds	202,106,850	179,465,871	22,640,979	12.6
Value	$2,352,746	$2,446,576	[1]$93,830	[1]3.8
Coal tar products:				
Distillery products	$364,642	$826,546	[1]$461,904	[1]55.9
Chemicals from	$504,176	$512,264	[1]$8,088	[1]1.6
Cyanides:				
Potassium and sodium—				
Pounds	2,928,584	2,317,280	611,304	26.4
Value	$388,438	$601,362	[1]$212,924	[1]35.4
Ferrocyanide (yellow prussiate of potash)—				
Pounds	5,027,264	6,165,406	[1]1,138,142	[1]18.5
Value	$683,277	$994,014	[1]$310,737	[1]31.3
All other	$107,389	$129	$107,260	83,147.3
Wood distillation:				
Alcohol, wood—				
Crude—				
Gallons	6,684,871	4,191,379	2,493,492	59.5
Value	$2,161,813	$1,660,061	$501,752	30.2
Refined—				
Gallons	5,162,346	3,038,218	2,124,128	69.9
Value	$3,129,486	$2,297,008	$832,478	36.2
Acetate of lime—				
Tons	52,571	43,413	9,158	21.1
Value	$1,474,982	$981,286	$493,696	50.3
Charcoal—				
Bushels	25,420,055	17,155,440	8,264,615	48.2
Value	$1,205,273	$726,809	$478,464	65.8
All other	$365,179	$10,452	$354,727	3,393.9
Fertilizers:				
Superphosphates—				
From minerals, bones, etc.—				
Tons	768,858	925,008	[1]156,150	[1]16.9
Value	$7,557,257	$8,492,360	[1]$935,103	[1]11.0
Ammoniated—				
Tons	775,987	142,898	633,089	443.0
Value	$12,901,057	$2,449,388	$10,451,669	426.7

[1] Decrease.

TABLE 6.—*Quantity and value of products, with amount and per cent of increase: 1905 and 1900*—Continued.

	CENSUS. 1905	CENSUS. 1900	Increase.	Per cent of increase.
Fertilizers—Continued.				
Complete—				
Tons	1,329,149	1,454,389	[1]125,240	[1]8.6
Value	$25,673,511	$25,796,143	[1]$122,632	[1]0.5
All other—				
Tons	397,295	299,910	97,385	32.5
Value	$4,435,755	$4,276,794	$158,961	3.7
Bleaching materials:				
Hypochlorites—				
Tons	5,946	2,143	3,803	177.5
Value	$137,196	$115,608	$21,588	18.7
All other	$622,079	$376,478	$245,601	65.2
Electro-chemicals	$6,146,879	$1,305,368	$4,841,511	370.9
Dyestuffs:				
Natural [2]—				
Pounds	50,516,953	49,019,074	1,497,879	3.1
Value	$1,904,107	$2,658,008	[1]$753,901	[1]28.4
Artificial [3]—				
Pounds	24,681,085	11,168,308	13,512,777	121.0
Value	$2,469,100	$2,256,678	$212,422	9.4
Tanning materials:				
Natural—				
Ground or chipped—				
Pounds	43,062,350	49,002,037	[1]5,939,687	[1]12.1
Value	$314,291	$465,956	[1]$151,665	[1]32.6
Extracts—				
Pounds	181,187,192	62,012,788	119,174,404	192.2
Value	$2,948,561	$1,259,007	$1,689,554	134.2
Artificial [4]—				
Pounds	49,584,429	2,454,084	47,130,345	1,920.5
Value	$1,904,379	$65,155	$1,839,224	2,822.8
Paints and varnishes:				
Pigments—				
White lead, dry—				
Tons	31,198	58,051	[1]26,853	[1]46.3
Value	$2,877,109	$4,211,181	[1]$1,334,072	[1]31.7
Lead oxides—				
Tons	24,867	25,380	[1]513	[1]2.0
Value	$2,591,772	$2,550,340	$41,432	1.6
Lamp and other blacks—				
Pounds	20,298,385	7,519,345	12,779,040	169.9
Value	$639,950	$420,037	$219,913	52.4
Fine colors—				
Pounds	7,780,330	4,080,902	3,699,428	90.7
Value	$1,076,853	$1,028,754	$48,099	4.7
Iron oxides and other earth colors—				
Pounds	48,745,978	33,772,256	14,973,722	44.3
Value	$332,616	$324,902	$7,714	2.4
Dry colors [5]—				
Tons	68,061	83,867	[1]15,806	[1]18.9
Value	$4,286,412	$4,428,028	[1]$141,616	[1]3.2
Pulp colors, sold moist—				
Pounds	25,505,482	20,060,935	5,444,547	27.1
Value	$931,131	$861,531	$69,600	8.1
Paints—				
In oil or paste [6]—				
Tons	174,218	153,239	20,979	13.7
Value	$19,942,072	$17,603,127	$2,338,945	13.3
Already mixed for use—				
Gallons	22,386,206	16,900,350	5,485,856	32.5
Value	$20,454,256	$14,870,685	$5,583,571	37.5
Varnishes—				
Oil and turpentine—				
Gallons	17,162,719	14,286,758	2,875,961	20.1
Value	$15,702,997	$14,337,461	$1,365,536	9.5
Alcohol—				
Gallons	1,569,362	563,212	1,006,150	178.6
Value	$2,199,213	$943,069	$1,256,144	133.2
Pyroxylin—				
Gallons	215,887	204,069	11,818	5.8
Value	$283,783	$237,012	$46,771	19.7
Japan, lacquers, and liquid dryers	$3,348,653	$3,085,254	$263,399	8.5
All other	$17,278,518	$3,017,152	$14,261,366	472.7
Explosives:				
Gunpowder—				
Tons	107,910	61,657	46,253	75.0
Value	$8,919,460	$5,310,351	$3,609,109	68.0
Nitroglycerin—				
Pounds	7,935,936	3,618,692	4,317,244	119.3
Value	$1,620,117	$783,299	$836,818	106.8
Gun cotton or pyroxylin—				
Pounds	340,637	369,499	[1]28,862	[1]7.8
Value	$202,322	$189,623	$12,699	6.7
Dynamite—				
Tons	65,460	42,923	22,537	52.5
Value	$12,900,193	$8,247,223	$4,652,970	56.4

[1] Decrease.
[2] Includes logwood and other extracts and ground and chipped wood.
[3] Includes mordants, iron liquor, red liquor, turkey red oil, sizes, gums, and dextrin.
[4] Includes chrome tannage solution and other tanning liquids and tannic acid.
[5] Comprises all other dry pigments than those enumerated above.
[6] Includes white lead in oil.

TABLE 6.—*Quantity and value of products, with amount and per cent of increase: 1905 and 1900*—Continued.

	CENSUS. 1905	CENSUS. 1900	Increase.	Per cent of increase.
Explosives—Continued.				
Smokeless powder—				
Pounds	6,009,855	2,973,126	3,036,729	102.1
Value	$3,938,073	$1,655,948	$2,282,125	137.8
All other	$150,798	$850,453	[1]$699,655	[1]82.3
Plastics:				
Pyroxylin	$2,857,093	$1,970,387	$886,706	45.0
All other	$1,898,668	$129,013	$1,769,655	1,371.7
Essential oils:				
Natural—				
Pounds	462,667	838,688	[1]376,021	[1]44.8
Value	$1,023,937	$701,173	$322,764	46.0
Witch hazel—				
Gallons	797,700	110,260	687,440	623.5
Value	$367,873	$54,649	$313,224	573.2
Artificial	$65,250	$54,460	$10,790	19.8
Compressed and liquefied gases:				
Anhydrous ammonia	$1,173,184	$448,157	$725,027	161.8
Carbon dioxide	$1,343,966	$696,164	$647,802	93.1
All other	$274,209	$70,690	$203,519	287.9
Fine chemicals:				
Alkaloids—				
Ounces	4,494,525	4,054,478	440,047	10.9
Value	$2,925,789	$1,750,503	$1,175,286	67.1
Gold salts—				
Ounces	59,969	12,347	47,622	385.7
Value	$449,864	$120,696	$329,168	272.7
Silver salts—				
Ounces	1,743,882	1,606,108	137,774	8.6
Value	$683,761	$627,252	$56,509	9.0
Platinum salts—				
Ounces	19,068	8,112	10,956	135.1
Value	$175,682	$61,400	$114,282	186.1
Chloroform—				
Pounds	616,670	396,540	220,130	55.5
Value	$165,604	$98,070	$67,534	68.9
Ether—				
Pounds	871,394	263,238	608,156	231.0
Value	$440,240	$129,876	$310,364	239.0
Acetone—				
Pounds	1,300,395	1,638,715	[1]338,320	[1]20.7
Value	$161,320	$178,666	[1]$17,346	[1]9.7
All other	$4,162,137	$1,435,465	$2,726,672	190.0
General chemicals:				
Glycerin—				
Pounds	18,791,997	15,383,798	3,408,199	22.2
Value	$2,345,205	$2,012,886	$332,319	16.5
Cream of tartar—				
Pounds	11,553,660	10,620,000	933,660	8.8
Value	$2,263,872	$2,081,500	$182,372	8.8
Epsom salts—				
Pounds	17,658,535	7,559,809	10,098,726	133.6
Value	$159,517	$57,966	$101,551	175.2
Sodium phosphates—				
Pounds	12,018,815	3,478,350	8,540,465	245.5
Value	$243,822	$104,554	$139,268	133.2
Tin salts—				
Pounds	10,676,941	4,677,471	5,999,470	128.3
Value	$1,092,980	$470,159	$622,821	132.5
All other	$21,947,072	$18,935,201	$3,011,871	15.6

[1] Decrease.

The increase of $79,663,140 in the aggregate value of products indicates that the condition of the industries grouped under chemicals and allied products was, on the whole, most prosperous in the census year 1905. Nevertheless, in the case of 18 of the products enumerated in Table 6, a decrease was reported either in quantity or in value, or both, at the census of 1905 as compared with that of 1900. In some cases these decreases were not actual, but merely due to the manner of tabulation; as in many instances establishments classified under this heading in 1900 have been transferred in 1905 to other classifications because of a change in their principal product. The coal tar products may be cited as an example. Through the growth of the manufacture of tarred paper and other materials of this class the value of these materials has come, in several establishments, to exceed that of the coal tar distillery products and the chemicals made from them

in these same establishments, and thus establishments which at the census of 1900 were classified as engaged in the manufacture of coal tar products were, at the census of 1905, classified as engaged in the manufacture of roofing and roofing materials. In such instances it is endeavored, when possible, to obtain from the returns of these establishments the quantity and value of the subsidiary coal tar products reported, and to combine these figures with those from the establishments in which coal tar products were the principal products, so as to give as complete a view as possible of the special industry. The results of this method as applied to this and other industries are set forth further on, where the different subindustries are treated in detail.

The decreases in some items shown in Table 6 may be ascribed to an increase in the practice of using within an establishment products of its manufacture in the manufacture of other products. Thus the decrease in the quantity and value of natural tanning materials, ground or chipped, is more than offset by the increase in the quantity and value of the extracts, which indicates that establishments which formerly sold their natural tanning material in the ground or chipped condition are now using much of it in the preparation of tanning extracts, and thereby securing the additional profit and advantage which results from further manufacture. The reduction in the quantity and value of dry white lead, as produced for sale, may also be due partly to establishments engaged in the corrosion of lead extending their operations to grinding this white lead in oil before offering it for sale, and thereby converting the pigment into a paint. Cases which arise, such as the two mentioned, will also be considered in the detailed discussion of the subclasses.

Table 7.—*Products consumed in establishments where manufactured, with amount and per cent of increase: 1905 and 1900.*

KIND.	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Sulphuric acid, tons	968,445	764,355	204,090	26.7
Nitric acid, pounds	62,116,306	32,123,221	29,993,085	93.4
Mixed acids, pounds	75,337,623	20,902,371	54,435,252	260.4
Acid phosphate, tons	884,211	839,966	44,245	5.3
Charcoal, bushels	12,183,896	1,719,675	10,464,221	608.5
Ether, pounds	2,742,154	1,193,264	1,548,890	129.8
Lead oxides, pounds	13,589,147	2,080,374	11,508,773	553.2
Nitrate of ammonia, pounds	2,552,472	158,307	2,394,165	1,512.4
Nitroglycerin, pounds	44,077,828	31,661,806	12,416,022	39.2
Pyroxylin, pounds	2,938,266	1,964,345	973,921	49.6
White lead, dry, tons	77,793	65,811	11,982	18.2
All other products consumed, tons	2,561,666	272,560	2,289,106	839.9

Table 7 shows that at the census of 1905, as compared with that of 1900, there was an increased consumption of products in the establishments in which they were manufactured, in the case of every substance mentioned in the table. The amount of increase was greatest in the case of sulphuric acid and least in the case of pyroxylin. The percentage of increase was greatest in the case of nitrate of ammonia and least in the case of acid phosphate. The increases recorded were undoubtedly all due to active business conditions and an improved demand for these products, except perhaps in the case of charcoal. In this instance certain establishments making charcoal for use in blast furnaces by wood distillation methods were, at the present census, by the operation of the Census rule for classification, transferred to the group "chemicals and allied products" from the group "iron and steel and their products" or the group "lumber and its remanufactures," where they were placed at the census of 1900.

The figures of Table 7 are of special interest when considered in connection with those of Table 6. Thus, for instance, the returns for lead oxides and white lead, dry, given in Table 7, confirm the opinion that the decreases shown for these products in Table 6 were due largely to their increased consumption in further manufacture in the establishments where they were originally manufactured.

Class I. A.—Sulphuric, Nitric, and Mixed Acids.

Sulphuric acid, which has been known to man since the eighth century, and which has been manufactured on a commercial scale in the United States since 1793, is so extensively used in the manufacture of other chemical products that the statistics for its production have been regarded as a safe criterion by which to gauge the activity of a country in chemical manufactures. Nitric acid was manufactured in this country as early as 1834. Mixed acids, which are mixtures of sulphuric and nitric acids in various proportions, came into commercial use about 1860, and the consumption of them for the manufacture of nitroglycerin, gun cotton, picric acid, and a large number of organic nitrates and nitro-substitution bodies has grown rapidly.

The classification "sulphuric, nitric, and mixed acids" is adopted for the first time at the present census, the industry having now attained such magnitude and significance as to warrant it. The statistics for sulphuric acid have been collected separately at each census, beginning with the census of 1870, and at the censuses of 1890, 1900, and 1905 the quantities and values of each of the important commercial grades of the acid were also ascertained. The statistics for nitric and mixed acids were first collected separately at the census of 1900. The statistics for the three acids named were presented in the special report on chemicals and allied products for 1900 in conjunction with those for muriatic, boric, acetic, lactic, citric, tartaric, and other acids, under the heading "acids." The returns for 1900 were, however, so recorded that it has been possible to separate accurately the returns for sulphuric, nitric, and mixed acids from those for the other acids reported, so that a comparison of the statistics for these three acids for the last two censuses may be made. These statistics are sum-

marized in Table 8, which gives only the statistics of establishments engaged primarily in the manufacture of the products in question.

TABLE 8.—*Sulphuric, nitric, and mixed acids—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	32	34	[1]2	[1]5.8
Capital	$12,761,920	$13,981,506	[1]$1,219,586	[1]8.7
Salaried officials, clerks, etc., number	308	298	10	3.4
Salaries	$556,106	$388,346	$167,760	43.2
Wage-earners, average number	2,447	2,356	91	3.9
Total wages	$1,505,406	$1,327,549	$177,857	13.4
Miscellaneous expenses	$712,953	$414,978	$297,975	71.8
Materials used, total cost	$4,972,838	$4,033,238	$939,600	23.3
Pyrites—				
Tons	197,847	197,459	388	0.2
Cost	$967,207	$953,680	$13,527	1.4
Sulphur—				
Tons	23,044	24,858	[1]1,814	[1]7.3
Cost	$479,529	$459,102	$20,427	4.4
Nitrate of soda—				
Tons	27,406	29,301	[1]1,895	[1]6.5
Cost	$1,143,280	$974,429	$168,851	17.3
All other materials	$2,382,822	$1,646,027	$736,795	44.8
Products, total value	$9,052,646	$8,596,390	$456,256	5.3
Sulphuric acid, 50° Baumé—				
Tons	467,614	452,942	14,672	3.2
Value	$4,286,312	$4,071,848	$214,464	5.3
Nitric acid—				
Pounds	30,306,555	20,402,570	9,903,985	48.5
Value	$1,446,471	$1,028,266	$418,205	40.7
Mixed acids—				
Pounds	42,812,894	42,301,319	511,575	1.2
Value	$1,222,295	$1,109,758	$112,537	10.1
All other products	$2,097,568	$2,386,518	[1]$288,950	[1]12.1

[1] Decrease.

Although the total number of establishments primarily engaged in the manufacture of sulphuric, nitric, and mixed acids, the capital employed, the quantities of sulphur and nitrate of soda used, and the value of "all other products" were less at the census of 1905 than at that of 1900, a healthy growth is indicated by the fact that there was an increase in all the other items. The relative increase in yields especially indicates improvement in operation.

The products included in Table 8 are those only which are produced for sale, and by establishments in which they constitute the principal product. A better idea of the industry may be gained by combining with the figures given those for the acid produced by establishments in which it constitutes a subsidiary product, and also those for acid which is produced and consumed in the same establishment in further manufacture, giving to this "consumed" acid the average value per unit of its grade so as to obtain a total value for the product. Among establishments of this kind may be mentioned chemical works in which various other acids, bases, salts, or other compounds are produced having a value greater than the sulphuric, nitric, or mixed acids produced for sale, or which consumed one or more of these acids in further manufacture; fertilizer works where sulphuric acid is extensively produced and used in making superphosphates; explosive factories where the sulphuric and nitric acids produced are converted into mixed acids and consumed in the manufacture of nitroglycerin or gun cotton and other cellulose nitrates; petroleum refineries where the sulphuric acid produced is consumed in refining oil; and smelting works where sulphuric acid is obtained from the sulphur fumes. This method has been adopted in treating of sulphuric acid so that comparisons may be made showing the growth in the production at the different censuses.

Sulphuric acid.—The census of 1870 was the first at which separate statistics were given for sulphuric acid, and then only for the number of establishments and the total value of the product. From evidence since obtained it is believed that these statistics are deficient, and that at that time there were probably 25 establishments in operation, yielding a product of over $1,000,000 in value. At the census of 1880 the total quantity of sulphuric acid was also reported, as well as its value and the number of establishments producing it.

TABLE 9.—*Sulphuric acid—number of establishments and quantity and value of products: 1870 to 1905.*

CENSUS.	Establishments.	Quantity (tons).	Value.
1905	[1]149	1,642,262	$15,174,886
1900	[2]127	1,352,730	14,247,185
1890	105	692,389	7,679,473
1880	49	154,383	3,661,876
1870	4	(3)	212,150

[1] Includes 117 establishments engaged primarily in the manufacture of other products.
[2] Includes 93 establishments engaged primarily in the manufacture of other products.
[3] Not reported.

TABLE 10.—*Sulphuric acid—increase and per cent of increase in quantity and value of products: 1870 to 1905.*

CENSUS PERIOD.	INCREASE.		PER CENT OF INCREASE.	
	Quantity (tons).	Value.	Quantity (tons).	Value.
1900 to 1905	289,532	$927,701	21.4	6.5
1890 to 1905	949,873	7,495,413	137.2	97.6
1880 to 1905	1,487,879	11,513,010	963.8	314.4
1870 to 1905	(1)	14,962,736	(1)	7,052.9
1890 to 1900	660,341	6,567,712	95.4	85.5
1880 to 1890	538,006	4,017,597	348.5	109.7
1870 to 1880	(1)	3,449,726	(1)	1,626.1

[1] Not reported.

Sulphuric acid is produced in several grades: (1) 50° Baumé, or chamber acid, containing on an average 51.04 per cent of SO_3; (2) 60° Baumé, containing on an average 63.7 per cent of SO_3; (3) 66° Baumé, known as oil of vitriol, containing on an average 76.35 per cent of SO_3; and (4) oleum, which consists of SO_3 dissolved in a sulphuric acid, containing 97 to 98 per cent of H_2SO_4. Pure pyrosulphuric acid contains 89.89 per cent of SO_3. The commercial article, called "oleum," usually contains 30 per cent of free SO_3, or a total of 87.14 per cent of free and combined SO_3. Beginning with the census of 1890 the statistics for the separate grades have been collected, and it thus becomes possible to show more definitely the condition of the industry at the different censuses, although the sum

total of all the grades gives but an incomplete statistical view of the industry. It is also possible to reduce all the grades to a common basis, as, for instance, to the basis of 50° Baumé, or chamber acid. For this purpose the quantity given for 60° Baumé is multiplied by the factor 1.25; that given for 66° Baumé, by the factor 1.50; and that given for oleum, by the factor 1.71.

TABLE 11.—TOTAL QUANTITY AND VALUE OF SULPHURIC ACID, BY GRADES: 1890 TO 1905.

GRADE.	1905			1900			1890		
	Quantity (tons).	Value.	Value per ton.	Quantity (tons).	Value.	Value per ton.	Quantity (tons).	Value.	Value per ton.
Total reduced to 50° Baumé acid	[1] 1,869,437			[2] 1,548,123		$9.20	[3] 783,569		
Total	1,642,262	$15,174,886		1,352,730	$14,247,185		692,389	$7,679,473	
50° Baumé	1,169,141	8,314,646	$7.11	953,439	7,965,832	8.35	504,932	4,307,067	$8.53
60° Baumé	48,688	581,523	11.94	17,012	246,284	14.47	10,190	122,940	12.06
66° Baumé	411,165	5,917,699	14.39	382,279	6,035,069	15.78	177,267	3,249,466	18.33
Oleum	13,268	361,018	27.20						

[1] Includes 968,445 tons, with an assigned value of $7,232,675, consumed in establishments where manufactured; and also sulphuric acid produced by establishments engaged primarily in the manufacture of other products.
[2] Includes 764,355 tons, with an assigned value of $7,032,066, consumed in establishments where manufactured; and also sulphuric acid produced by establishments engaged primarily in the manufacture of other products.
[3] Includes 290,768 tons, for which no value was assigned, consumed in establishments where manufactured; and also sulphuric acid produced by establishments engaged primarily in the manufacture of other products.

Comparing the total quantities reduced to the common basis of 50° Baumé, it appears that the increase for 1900 over 1890 was 764,554 tons; and for 1905 over 1900, 321,314 tons. The per cent of increase for 1900 over 1890 was 97.6; and for 1905 over 1900, 20.8. The value per ton for each grade has been consistently lower at each census except for the 60° Baumé. For this grade a higher value was reported at the census of 1900 than at that of 1890, but the value reported at the census of 1905 is less than that for 1890, and is in harmony with the values reported for the other grades at the present census. This progressive reduction in the cost of sulphuric acid is a matter of prime importance, since this acid is used to so large an extent in the manufacture of other products.

Oleum appears for the first time in any census at the census of 1905. This is due to the fact that it is readily produced by the contact process, which was described in detail in the 1900 report on chemicals and allied products, and which had then but recently been made commercially operative and introduced into this country.

The geographic distribution of the manufacture of sulphuric acid is shown in Table 12, which includes all establishments, making it either as a principal or as a subsidiary product, reported at the censuses of 1900 and 1905.

Establishments manufacturing sulphuric acid were reported from 25 states at the census of 1900, and 26 at that of 1905. At the census of 1900 New Jersey held first rank in the number of establishments, Georgia second, Maryland and South Carolina third, and New York and Pennsylvania fourth. Each of the remaining states reported less than 10 establishments in operation. At the census of 1905 Georgia held first rank, and was followed by Pennsylvania, New Jersey, South Carolina, and New York, in the order named.

TABLE 12.—*Sulphuric acid—number of establishments, by states and territories: 1905 and 1900.*

STATE OR TERRITORY.	1905	1900
United States	[1] 149	[2] 127
Alabama	7	3
Arizona	1	1
California	8	7
Colorado	1	1
Connecticut	2	2
Florida	1	1
Georgia	20	15
Illinois	3	2
Indiana	3	2
Kansas	3	
Louisiana	3	3
Maine		1
Maryland	9	12
Massachusetts	4	4
Michigan	3	1
Mississippi	1	1
Missouri		1
New Jersey	13	18
New York	10	11
North Carolina	7	6
Ohio	9	3
Pennsylvania	16	11
Rhode Island	1	1
South Carolina	11	12
Tennessee	4	3
Texas	1	
Virginia	7	5
Wisconsin	1	

[1] Includes 117 establishments engaged primarily in the manufacture of other products.
[2] Includes 93 establishments engaged primarily in the manufacture of other products.

None of the remaining states reported 10 establishments in operation. Maine and Missouri each reported 1 establishment in operation at the census of 1900, but none at the census of 1905, while Kansas, which reported 3 establishments, and Texas and Wisconsin, which reported 1 establishment each at the census of 1905 did not report any at the census of 1900. At the census of 1900, out of the total number of establishments reported, 95, or 74.8 per cent, were located in states bordering on the Atlantic ocean or the Gulf of Mexico, and at the census of 1905, of the establishments reported, 97, or 65.1 per cent, were so located.

TABLE 13.—*Sulphuric acid—quantity of products, by geographic divisions: 1905 and 1900.*

DIVISION.	1905	1900
	Tons.	*Tons.*
United States	1,869,437	1,548,123
North Atlantic	768,647	734,669
South Atlantic	540,593	520,575
North Central	349,906	153,979
South Central	141,107	87,665
Western	69,184	51,235

An increase is shown in each of the divisions, the largest increase, 195,927 tons, having occurred in the North Central division, and the smallest, 17,949 tons, in the Western; while the greatest percentage of increase was that for the North Central.

The census of 1900 was the first at which statistics were given with any detail as to the kinds, quantities, and values of the principal materials. At that census there were reported, as having been used in the manufacture of sulphuric acid, 633,837 tons of pyrites, having a value of $3,101,075, and 70,288 tons of sulphur, having a value of $1,396,975.

At the census of 1905 there were reported 707,326 tons of pyrites, having a value of $3,895,905, and 47,861 tons of sulphur, having a value of $1,022,644. This represents an increase in pyrites, for 1905 as compared with 1900, of 73,489 tons, or 11.6 per cent, in quantity and $794,830, or 25.6 per cent, in value, and a decrease in sulphur of 22,427 tons, or 31.9 per cent, in quantity and $374,331, or 26.8 per cent, in value.

The quantity of nitrate of soda used in the manufacture of sulphuric acid can not be directly ascertained, for the reason that in establishments producing sulphuric acid it is used for other purposes also, varying with the nature of the establishment, as, for example, in making nitric acid, fertilizers, gunpowder, dynamite, or saltpeter; and for the further reason that the nitrate used for all purposes in a single establishment is reported in gross. Analysis of returns, however, shows that on the average 1 part of nitrate is used to every 100 parts of 50° Baumé acid produced. Bearing in mind that no nitrate is used in the contact processes, it is estimated that in 1900 there was used in making sulphuric acid 15,481 tons of nitrate of soda, and in 1905, 18,467 tons. The ratio of nitrate to total acid will probably decrease greatly in the future.

In the report on sulphuric acid for the census of 1880 it was stated that there were then 3 establishments in the United States burning pyrites, from which it is inferred that the other 46 were burning brimstone, as sulphur is usually styled in this industry. In the census report for 1890 no mention is made of the kind of materials used. At the census of 1900 there were 77 establishments burning pyrites only, 31 burning brimstone only, 17 burning both pyrites and brimstone, and 2 producing the acid from the roaster gases in zinc smelting. At the census of 1905 there were 114 establishments burning pyrites only, 19 burning brimstone only, 10 burning both pyrites and brimstone, 5 producing acid from the roaster gases in zinc smelting, 1 producing acid from the roaster gases in copper smelting, and 5 engaged in the recovery from spent or sludge acid. Two of the pyrite plants were also engaged in the recovery of spent acids.

The total amount of recovered acid included in the product for 1905 was approximately 73,346 tons. It is probable that the amount of sulphuric acid recovered, or regained, during the census year was much greater than this, for in many establishments, such as explosives factories, it has been the practice to recover and reuse the acid again and again, and the acid so recovered is not reported. This practice is, however, now being supplanted by that of rebuilding the spent acid with oleum. At the census of 1900 the quantity of acid reported as produced in zinc smelting was 58,828 tons, having a value of $424,670; and at the census of 1905 the quantity so reported was 94,032 tons, having a value of $576,060. This represents a gain for 1905 over 1900 of 35,204 tons, or 59.8 per cent, in quantity and of $151,390, or 35.6 per cent, in value.

The increase between 1900 and 1905 in the number of establishments burning pyrites was 30, or 31.9 per cent; while for those burning pyrites only it was 37, or 48.1 per cent. The decrease for the same period in the number of establishments burning brimstone was 19, or 39.6 per cent; while for those burning brimstone alone it was 12, or 38.7 per cent.

At the census of 1905 the average yield for 105 establishments burning pyrites only was 211 pounds of sulphuric acid, reduced to 50° Baumé, for 100 pounds of pyrites. At the census of 1900 the average for the 39 works for which data are available was 206 pounds of acid for 100 of pyrites. The theoretical yield of chamber acid is given later. In practice 240 pounds have been obtained. At the census of 1905 the average yield for 15 establishments burning brimstone only was 432 pounds of sulphuric acid, reduced to 50° Baumé, for 100 pounds of brimstone. At the census of 1900 the average for the 20 works for which data are available was 402 pounds of acid for 100 pounds of brimstone. The theoretical yield of chamber acid is given later. In practice 446 pounds have been obtained. In the report on this industry for 1900 attention was called to the large use of sulphur in the United States, while practically no brimstone acid was being made in England or on the continent of Europe. The statistics for the present census indicate that our manufacturers are coming into conformity with European practice.

The large use made of pyrites and of sulphur in the sulphuric acid industry and the continued growth of

this industry make it proper to inquire into the extent to which these raw materials are available.

TABLE 14.—*Pyrites produced in, and imported into, the United States: 1895 to 1904.*[1]

YEAR.	PRODUCED.		IMPORTED.[2]	
	Quantity (long tons).	Value.	Quantity (long tons).	Value.
1895	99,549	$322,845	190,435	$673,812
1896	115,483	320,163	200,168	648,396
1897	143,201	391,541	259,546	747,419
1898	193,364	593,801	252,773	717,813
1899	174,734	543,249	269,868	1,077,061
1900	204,615	749,991	322,484	1,055,121
1901	[3] 241,691	1,257,879	403,706	1,415,149
1902	[3] 207,874	947,089	440,363	1,650,852
1903	[3] 233,127	1,109,818	420,410	1,636,450
1904	[3] 333,542	3,460,863	422,720	1,533,997

[1] United States Geological Survey, "Mineral Resources of the United States, 1904."

[2] Iron pyrites containing 25 per cent or more of sulphur and not more than 3.5 per cent of copper.

[3] Includes production of natural sulphur.

The chief sources of the supply of pyrites imported into the United States are the celebrated Rio Tinto and Tharsis mines of the Huelva district in Spain; the San Domingo mine at Pomaron, Portugal; and the Tilt Cove mines of Pilleys Island, Newfoundland. The residue from the roasting or burning of pyrites is known as pyrites cinders. Sometimes the pyrites contain gold, silver, or other valuable metals in sufficient quantity to warrant treatment to recover these values, and as the sulphur present renders such ores refractory, it is the practice in some instances to send them to sulphuric acid works to be burnt, the cinders then being returned. Under such circumstances no cost is assigned to the pyrites by the sulphuric acid works. Pyrites cinders is useful in smelting acid ores, as the contact mass in certain processes of making sulphuric acid, and in the manufacture of pigment and of copperas; it is also sometimes used as an iron ore in the blast furnace for making pig iron. In 1900 there were returned 62,701 tons of pyrites cinders, having a value of $105,631, and in 1905, 163,276 tons, having a value of $200,940. It is evident that but a small portion of the actual product is utilized.

Pure pyrite contains 53.3 per cent of sulphur. The pyrites commonly used for making sulphuric acid contain from 43 to 48 per cent. When the ore contains over 35 per cent of sulphur it can be ignited and, with a proper supply of air combustion, will continue until the greater part of the sulphur contents are burned, for there is sufficient heat generated by the process to maintain it. Such is not the case when the amount of sulphur in the ore is less than 35 per cent, and additional fuel is required with these low-grade ores.

The statistics for sulphur produced in this country from 1901 to 1904 are combined with those for pyrites, because the sulphur is largely the product of a single mine, and it is desired to avoid showing individual operations. The remainder of the sulphur used for all purposes is imported.

TABLE 15.—*Sulphur imported and entered for consumption in the United States: 1895 to 1904.*[1]

YEAR ENDING DECEMBER 31—	CRUDE.		FLOWERS OF SULPHUR.		REFINED.		Total value.
	Quantity (long tons).	Value.	Quantity (long tons).	Value.	Quantity (long tons).	Value.	
1895	121,286	$1,546,481	581	$12,888	229	$4,379	[2] $1,613,754
1896	138,168	1,967,454	665	13,266	447	8,226	[2] 2,172,629
1897	136,563	2,395,436	....	....	5,342	58,637	2,454,073
1898	151,225	2,891,767	507	14,548	12,772	163,609	3,069,924
1899	140,182	2,484,801	335	9,917	1,016	28,485	2,523,203
1900	166,825	2,917,172	628	17,437	259	8,385	2,942,994
1901	174,160	3,256,990	748	20,201	301	10,715	3,287,906
1902	170,601	3,334,002	738	19,954	41	3,694	3,357,650
1903	188,990	3,649,756	1,854	52,680	189	7,254	3,709,690
1904	127,996	2,462,360	1,332	39,133	204	9,776	2,511,269

[1] United States Geological Survey "Mineral Resources of the United States, 1904."

[2] Includes lac sulphur and other grades not otherwise provided for, but not pyrite.

It has been estimated that if the rate of increase in the consumption of pyrites and sulphur which obtained between 1893 and 1903 be maintained the amount of sulphur required in the United States in 1913 in the form of elemental sulphur or of sulphur bearing materials would amount to 1,045,875 long tons. As similar activity in manufacture is noted in several European countries, there is already a call for new sources of supply of raw materials. Fortunately there are many sulphur bearing materials, some of which are used as sources of the metals.

Table 16 presents the names of several of the more commonly occurring sulphur bearing minerals, with their formulas, and the number of tons of "real" sulphuric acid and of chamber acid which theoretically may be produced from a ton of each mineral when pure.

TABLE 16.—*Tons of real sulphuric acid and of chamber acid theoretically produced by a ton of each of the minerals specified.*

MINERAL.	Formula.	Real sulphuric acid.	Chamber acid.
Sulphur	S	3.06	4.93
Pyrite	$Fe\,S_2$	1.63	2.62
Marcasite	$Fe\,S_2$	1.63	2.62
Pyrrhotite	$Fe_{11}\,S_{12}$	1.18	1.90
Sphalerite	$Zn\,S$	1.01	1.63
Chalcopyrite	$Cu\,Fe\,S_2$	1.08	1.73
Bornite	$Cu_3\,Fe\,S_3$	0.86	1.38
Chalcocite	$Cu_2\,S$	0.62	1.00
Galenite	$Pb\,S$	0.41	0.66

Of the minerals named, sulphur, pyrite, and marcasite have long been used for making sulphuric acid. In the report for 1900 the use of sulphur for this purpose was traced back to Basilius Valentinus, living in the fifteenth century. The first proposal to use pyrites for this purpose is credited to an Englishman named Hill,[1] a patent for the process having been granted him in 1818. Little use was made of it until 1838, when the Sicilian government sold the monopoly of the export sulphur to a French firm, and the price of

[1] George Lunge, Manufacture of Sulphuric Acid and Alkali, edition 1903, Vol. I, pages 36 to 38.

crude brimstone was nearly trebled. Pyrites were found so satisfactory a substitute that they have steadily grown in favor ever since.

Pyrrhotite has come into use practically since the last census. Its value was demonstrated at Sault Ste. Marie, with Canadian ores, and the results were so satisfactory that works have been erected in which to utilize the pyrrhotite ores of Virginia. Pyrite, marcasite, and pyrrhotite, in the condition in which they occur as ores, are all embraced in pyrites.

Sphalerite is used as a source of zinc, and at each of the last two censuses sulphuric acid has been reported as having been produced in the process of zinc smelting. Pure zinc sulphide contains 32.9 per cent of sulphur, but the ores may range down to 18 per cent. In roasting these lower grade ores fuel is required in addition to that furnished by their sulphur contents. When this was added directly, as in earlier practice, the roaster gases were so dilute as to make the recovery of the sulphur difficult, but by roasting in muffles in such a manner as to keep the roaster gases separate from the fire gases, it has become possible to utilize the whole of the sulphur contents of the ore in vitriol chambers, and with the introduction of the contact process, it has even become feasible to recover it from the more highly diluted gases. As early as 1855 there was erected at Stolberg, Germany, a Hasenclever furnace by which the roaster gases from sphalerite, or zinc blende, could be converted into sulphuric acid.

Chalcopyrite, bornite, and chalcocite are copper ores. In 1905 a small amount of sulphuric acid was reported as having been produced in the process of copper smelting. The burner gases from copper smelting are quite lean in sulphur, yet as long ago as 1872 they were used at Altenau, Germany, in making sulphuric acid. By the use of a contact process their utilization becomes still more feasible. The Census report on mines and quarries for 1902 states that 11,780,064 tons of copper ores were mined in that census year, and it is well known that a large percentage of them were sulphur bearing ores.

No reports of sulphuric acid production have been received from any processes of smelting lead ores. Referring to galenite, Lunge says:[1] "Galena is probably nowhere worked in such a way as to extract its sulphur in the shape of sulphuric acid. The purest galena contains only 13.4 per cent of sulphur." The Census report on mines and quarries for 1902 states that 132,330 tons of nonargentiferous lead ore were mined in that census year. The greater part of this was sulphide ore. In addition, 9,787,804 tons of gold and silver ores were reported as being treated in that census year, much of which consisted of sulphurets, the sulphur from all of which was evidently lost in treatment. By Salom's process of electrolyzing galenite, however, hydrogen sulphide is obtained, and this may be converted into sulphuric acid.

[1] Manufacture of Sulphuric Acid and Alkali, edition 1903, Vol. I, page 85.

According to W. D. Harkins,[2] the amount of material of industrial value given out in smelter smoke in the United States is often enormous. The analysis of the smoke of one smelter showed an approximate daily output in smoke of 55,000 pounds of arsenic trioxide, 1,500 to 2,000 tons of sulphur dioxide, 150 tons of sulphur trioxide, 6,000 pounds of zinc, 5,000 pounds of copper, 6,000 pounds of lead, and 5,000 pounds of antimony. From private communications it is learned that 1 establishment is daily liberating into the atmosphere 850 tons of sulphur in various states of combination, and that another, in a widely different section of the country, is sending off in its smoke approximately 237,500 tons of sulphur dioxide per annum. It has been estimated[3] that a half million tons of sulphuric acid could be produced annually from the sulphur in the fuel burned in London.

This sulphur is not only wasted, but the emanations from smelters render the atmosphere noxious to man and other animals, and seriously affect the vegetation for considerable distances about the smelters. This has repeatedly led to litigation. So long ago as 1864 the owners of the works at Freiberg, Germany, were compelled to pay upward of $14,000 damages on account of the emanations from their works. The recovery and utilization of these gases and fumes will not only abate the evils to which they give rise, but will greatly increase the available supply of the sulphur compounds and other substances which are much used in our industries.

The Tennessee Copper Company has recently erected a plant for making acid from the gases of its smelting furnaces at Copperhill, Tenn., which are now operated on the pyrite principle. It has been determined that these gases average about 6 per cent in sulphur dioxide, and when the plant is in full operation their quantity will enable the production of upward of 700,000 tons of sulphuric acid of 50° B. per annum.[4]

Other sources of sulphur are found in the spent oxides from gas works, the waste liquors of Le Blanc soda works and of ammonia works, and in petroleum, such as the oils of Lima, Ohio, and of Canada. According to Pennock,[5] the hydrogen sulphide recoverable from by-product coke ovens is sufficient, when oxidized, to supply nearly one-half the sulphuric acid required in converting the ammonia into sulphate. According to Mabery,[6] "probably 50 tons of sulphur daily is a conservative estimate of the amount extracted from Ohio oil and burned off into the atmosphere." The

[2] Science, 1907, vol. 25, page 407.
[3] Nature, 1907, vol. 76, page 110.
[4] The Mineral Industry, 1906, vol. 15, page 708.
[5] Journal of American Chemical Society, 1906, vol. 28, page 1257.
[6] Ibid., page 432.

sulphur may be obtained from sulphur bearing petroleum in the form of hydrogen sulphide which can be burned to sulphuric acid. This method is practiced to some extent in the United States, but until it becomes more general the product must appear in census statistics as being produced from sulphur.

The sulphur gases obtained by the burning of pyrites and other sulphurets are usually impure because of the other minerals naturally occurring in the ore. As pointed out in the report for 1900, in the contact process there described, these gases are purified before being brought into the presence of the contact mass. In the chamber process it has been customary to use these gases as produced and then to purify the sulphuric acid when it was specially desired. According to Schatterbeck,[1] several hundred tons of arsenic sulphide, which is obtained in our chemical works in purifying sulphuric acid, are thrown away every year in the United States, yet our imports of arsenic compounds have for several years past amounted to from 6,000,000 to 8,000,000 pounds, having a value of from $243,380 to $416,525.

In the Census report for 1900 it was pointed out that owing to the contact process for the manufacture of sulphuric acid having been made a commercial success by the Badische Aniline und Soda Fabrik, a formidable competitor to the long used chamber process had been developed. As a result, the period since 1900 has been marked by much activity in endeavors to improve the chamber process and to devise contact processes that are independent of the Knietsch process. The improvements in the chamber process consist largely in a reassembling, proportioning, and arranging of the chambers, with the introduction of dust chambers, fans, and intermediate towers, and the use of atomized water in place of steam. A notable departure from previous practice is found in the Meyer's tangent system. The chambers in this system are cylindrical in form, with the entrance pipe for the burner gases so placed that the gases enter the top of the chamber tangentially, and travel along the periphery in a downward spiral, leaving the chamber by an opening near the bottom. By this means a higher efficiency for unit volume of chamber is obtained, and greater compactness of plant results. Hence the cost of installation and interest, and the area required for the plant are materially diminished. According to Guttmann,[2] "the production of acid for a given chamber space is with ordinary chambers now frequently 3 kilos of H_2SO_4 per cubic meter, but with the intensified working one arrives at 4 kilos. With atomized water and fans in ordinary chambers 5.84 kilos have been obtained. A set of Meyer's chambers, without other improvements, produces 4 kilos. * * * With fans and atomized water a Meyer set will probably reach 8 kilos and more; at any rate the first chamber of the system, which is not worked to its full capacity, produces 10 kilos, and more." Further, in comparing the chamber processes with contact processes, he says: "The conclusion is therefore justified, that a factory burning about 100 tons of pyrites per week, and having a chamber plant, equipped with all recent improvements, can successfully compete with a contact plant for even the strongest sulphuric acid in the market."

According to Lunge,[3] there are six contact processes now in use, styled respectively, Badische, or Knietsch, Höchst, Grillo, Mannheim, Freiberg, and Rabe, about which, through patent specifications, publications, or special communications, considerable detail is known, and several others which have been kept secret. In the Badische, Höchst, Grillo, and Mannheim processes the conversion of SO_2 into SO_3 is rendered practically complete by contact action, while in the Freiberg and Rabe processes the contact action is supplemented by lead chambers for working up the residual gases. The Grillo process is known in this country as the Schroeder process. Of the processes named by Lunge, five appear to be in use in the United States—the Knietsch, Schroeder, Mannheim, Höchst, and Rabe, while the American inventions of J. B. F. Herreshoff are also used. The Knietsch was described at length in the report for 1900, and it may suffice to add that in this system the unit is one having a capacity for treating 5,000 tons of 50 per cent ore a year. The Schroeder process was made the subject of a symposium before the New York Section of the Society of Chemical Industry in February, 1903, and from the report[4] of this symposium it appears that the process is distinguished by the use of a contact mass composed of soluble salts, principally sulphates, carrying the platinum. According to this report the following advantages are claimed for this method:

(1) The contact mass is easily regenerated, hence the kiln gases do not need to be purified as perfectly as if working with platinized insoluble vehicles.

(2) The calcined crusts are very porous, so that the contact mass made from them offers much less resistance to the gases passing through them than the tightly packed asbestos formerly used.

(3) The catalytic action of the contact mass made from soluble salts is far superior to that of platinized insoluble carriers, and the contents of the platinum in the contact mass, which were from 8 to 10 per cent of the weight of the asbestos in the old Schroeder plates, have been decreased to one-tenth of 1 per cent without reducing the efficiency of the contact material.

At present (1903) there are 23 Schroeder plants built or building—7 in Germany, 2 in Russia, 1 in Poland, 1 in Italy, 2 in France, 1 in Chile, 1 in Mexico, 2 in South Africa, and 6 in the United States. Some are using blendes, some pyrites, some brimstone, and one a

[1] United States Geological Survey, "Mineral Resources of the United States," 1905.

[2] Journal of Society of Chemical Industry, 1903, page 1334.

[3] Manufacture of Sulphuric Acid and Alkali, edition 1903, vol. 1, page 1012.

[4] Journal of Society of Chemical Industry, 1903, vol. 22, page 348.

low-grade gold ore. Some of the ores are quite free from objectionable impurities, while others are very impure, which necessitates different methods of purification.

The cost of the plant is less than that of a chamber and concentrating plant of the same capacity.

The advantage of the contact process is greater the stronger the acid made, the cost being the same per unit of sulphur for all strengths. For acid stronger than 60° B. it is cheaper than chambers; but for 50° B., and perhaps for 60° B., it has at present but little, if any, advantage.

One application of the process that promises to be of great importance is its use in connection with chamber plants to make strong acid, in place of concentrating in the usual manner. A plant is now being built for this purpose, and there is every reason to believe that it will show a marked economy, both in first cost and in operating expenses.

The Mannheim process was described by Wilke[1] before the New England Section of the Society of Chemical Industry in December, 1905, as follows:

This process is based on the following fundamental principles:

First. To use the heat of the ordinary roasting process for carrying on the catalytic action of the oxide of iron upon the sulphurous acid.

Second. The purification of the burner gases is a dry process. In all other processes the gases are washed and have to be dried again.

Third. The conversion or catalytic oxidation of that part of the sulphurous acid which passed through the iron contact, but had not been converted, is brought about by means of the waste heat of the burner gases.

Fourth. The whole process is carried on by moving the gases by means of exhausters only.

The roast gases leave the kilns at a temperature of about 700° C. This is the proper temperature necessary in the iron oxide to produce the conversion or catalytic action to transform the sulphurous acid into sulphuric anhydride. The iron oxide, at the above-mentioned temperature, forms iron arsenate, with the arsenious acid which is contained in the roast gases. If roast gases are taken at the temperature of the furnace through the oxide of iron, a large proportion of the sulphurous acid (50 to 60 per cent) is converted into sulphuric anhydride, while the arsenic contained in these roast gases combines with the oxide of iron.

Water contained in the gases to be converted reduces the catalytic property of the iron oxide. It is therefore necessary to produce the roast gases with dried air. The drying of the air necessary for the process is accomplished with sulphuric acid which is produced in the process.

The roast gases are produced in a furnace which is protected with an air-tight iron shell against any entrance of moist atmospheric air. The air necessary for the roasting process passes through towers which are scrubbed with sulphuric acid and is then conducted through air-tight pipes entering the furnace or kilns below the grate bars. The dry and hot roast gases so obtained are conducted to a shaft which is attached to the furnace and filled with oxide of iron (pyrites cinders). In this shaft part of the conversion takes place; that is, part of the sulphurous acid is converted into sulphuric anhydride, while at the same time the arsenic obtained in the roast gases is retained.

The roast gases therefore are subjected to a dry purification, and are considerably reduced in their contents of sulphurous acid. After the sulphuric anhydride which is formed in this first part of the process has been absorbed, the rest of the sulphurous acid contained in the gases can be converted into sulphuric anhydride by means of a very small amount of platinum. To do this, it is necessary to remove any small quantities of sulphuric acid (monohydrate) which have not been absorbed. This is accomplished by passing the gases through layers of porous material which is not affected by sulphuric acid. The main part of the sulphuric acid which is carried over mechanically is eliminated or retained in this way. The purified gases are now allowed to pass through layers of granulated basic blast-furnace slag.

The gases which have passed through the iron contact mass contain sufficient heat to reheat the filtered gases to the temperature necessary for catalytic action in the platinum contact.

It would be possible to utilize this heat by giving it off to the filtered gases. But the sulphuric acid (monohydrate) must be carried along in the form of vapor. The heat, therefore, must not be reduced too much to keep the monohydrate in a gaseous state. The heat given off in the heater located over the iron contact is not sufficient to raise the filtered gases to the temperature necessary to carry on catalytic action in the platinum contact. It is, therefore, necessary to have a small coal fire to raise these gases to their proper temperature.

The platinum contact apparatus must be built in such a way that it does not offer much resistance to the passage of the gases, in order to move them with an ordinary exhauster. This is accomplished by using a number of platinized asbestos nets, the meshes of which are such that the resistance in the whole apparatus does not represent more than the pressure of a column of water about 30 millimeters high. In constructing the platinum contact apparatus in this way, it is possible to exchange a single element during the process in the course of a few minutes without interruption. In this process it is possible to have a conversion of the roast gases up to 95 per cent.

The first plant in the United States was erected in 1903, in the works of the Schoellkopf, Hartford, and Hanna Company, in the city of Buffalo, N. Y. This plant consisted then of one unit with a capacity of about 1,600 tons of sulphuric acid or its equivalent. The original plant has since been enlarged to four times its original capacity. Besides this plant, four other firms have adopted this process, and there are now in use twenty-two units with a capacity of about 35,000 tons, and in the course of construction, ten more units with a capacity of 16,000 tons. This is a total capacity of over 50,000 tons per year. This has been accomplished in a little over two years since the process has first been introduced here.

This process does not require complicated or delicate pieces of apparatus, a staff of scientific men, nor any special apparatus for the purification of the roast gases, as this is done in the furnace itself. The amount of fuel consumed and motive power required is smaller than in any other known process, and the plant can be built up gradually on account of the units being small and being easily arranged in groups. The cost of repairs is very low.

According to Falding (V. Internationaler Kongress für Angewandte Chemie, 1904, vol. 1, page, 768), the following sulphuric acid plants were completed or in course of construction in the United States between 1900 and 1903:

Contact process plants.

NAME AND LOCALITY.	Process.
New Jersey Zinc Co., Mineral Point, Wis	Schroeder.
New Jersey Zinc Co., Hazard, Pa	Schroeder.
Peyton Chemical Co., Cal	Schroeder.
Repauno Chemical Co., near Wilmington, Del	Schroeder.
Dupont Powder Co., near Wilmington, Del	Schroeder.
Harrison Bros. & Co., near Philadelphia, Pa	Schroeder.
United Zinc & Chemical Co.. Argentine, Kans	Frasch converter.
—— Buffalo, N. Y	Mannheim.
General Chemical Co., near New York, two plants	(1)

[1] Inquiry has developed the fact that the General Chemical Company is operating a large number of contact plants, and that as rapidly as its chamber systems wear out it is replacing them by contact plants. This company operates under the Herreshoff patents and it also owns and utilizes the Knietsch, Höchst, and Rabe patents. This company expresses great satisfaction with the working of its contact processes and finds that the acid thus produced from pyrites is substantially free from iron and is superior to brimstone acid in its freedom from arsenic.

[1]Journal of Society of Chemical Industry, 1906, vol. 25, page 4.

Chamber process plants.

NAME AND LOCALITY.	Equipment.	Chamber capacity (cubic feet).
Total		6,400,000
Richmond Guano Co., Richmond, Va.	Four intermediate towers	178,000
E. Frank Coe & Co., Barren Island, N. Y.		225,000
Southwest Chemical Co., Argentine, Kans.	Fifteen Gilchrist columns and fans.	435,000
Lazaretto Guano Co., Baltimore, Md.	Nine Gilchrist columns and fans.	336,000
Western Chemical Co., Denver, Colo		450,000
Meridian Fertilizer Co., Meridian, Miss.	Pratt system	143,000
Bussey & Sons, Columbus, Ga	Pratt system	90,000
Greenville Fertilizer Co., Greenville, S. C.		135,000
Virginia-Carolina Chemical Co., Memphis, Tenn.		135,000
Anderson Fertilizer Co., Anderson, S. C.		124,000
Georgia Chemical Works, Rome, Ga		206,000
Philip Carey Manufacturing Co., Lackland, Ohio.		158,000
E. Rauh Sons Fertilizer Co., Indianapolis, Ind.	Two Gilchrist columns	101,000
Jackson Fertilizer Co., Jackson, Miss.	Three Gilchrist columns	220,000
Scott Bros. Fertilizer Co., Elkton, Md.		83,000
C. H. Dempwolf & Co., York, Pa		170,000
A. P. Brantley Sons Co., Blackshear, Ga.		101,000
Virginia State Fertilizer Co., Lynchburg, Va.	Four intermediate towers	148,000
Graselli Chemical Co., Birmingham, Ala.		400,000
Jarecki Chemical Co., Cincinnati, Ohio		140,000
Detroit Chemical Co., Detroit, Mich	Five Gilchrist columns	173,000
Federal Chemical Co., Nashville, Tenn	Thirteen Gilchrist columns.	278,000
Southern States Fertilizer Co., Savannah, Ga.	Pratt system	130,000
Virginia-Carolina Chemical Co., Dothan, Ala.	Hoffman	100,000
Ohio Farmers Fertilizer Co., Columbus, Ohio.	Hoffman	204,000
Armour Fertilizer Co., Atlanta, Ga		166,000
Virginia-Carolina Chemical Co., Savannah, Ga.	Hoffman intensifier	120,000
Merrimac Chemical Co., Boston, Mass		202,000
Sayles Bleacheries, Saylesville, R. I		10,000
Bowker Fertilizer Co., St. Bernard, Ohio.		141,000
T. P. Shepard & Co., Providence, R. I		140,000
Virginia-Carolina Chemical Co., Albany, Ga.		160,000
Standard Chemical and Oil Co., Troy, Ala.		150,000
F. S. Royster Guano Co., Columbia, S. C.	Seven Gilchrist columns	173,000
Griffith & Boyd	Meyer Tangential	75,000
Virginia-Carolina Chemical Co., Greenville, S. C.		200,000

Sulphuric acid is probably used for a greater variety of purposes, especially in the chemical arts, than any other substance. According to Lunge,[1] the principal applications are the following:

I. *In a more or less dilute state* (say from 144° Tw. downwards). For making sulphate of soda (salt cake) and hydrochloric acid, and therefore ultimately for soda ash, bleaching powder, soap, glass, and innumerable other products. Further, for superphosphates and other artificial manures. These two applications probably consume nine-tenths of all the sulphuric acid produced. Further applications are for preparing sulphurous, nitric, phosphoric, hydrofluoric, boric, carbonic, chromic, oxalic, tartaric, citric, acetic, and stearic acids; in preparing phosphorus, iodine, bromine, the sulphates of potassium, ammonium, barium (*blanc fixe*), calcium (*pearl-hardening*); especially also for precipitating baryta or lime as sulphates for chemical processes; sulphates of magnesium, aluminum, iron, zinc, copper, mercury (as intermediate stage for calomel and corrosive sublimate); in the metallurgy of copper, cobalt, nickel, platinum, silver; for cleaning copper, silver, etc.; for manufacturing potassium bichromate; for working galvanic cells, such as are used in telegraphy, in electroplating, etc.; for manufacturing ordinary ether and the composite ethers; for making or purifying many organic coloring matters, especially in the oxidizing mixture of potassium bichromate and sulphuric acid; for parchment paper; for purifying many mineral oils, and sometimes coal gas; for manufacturing starch, sirup, and sugar; for the saccharification of corn; for neutralizing the alkaline reaction of fermenting liquors, such as molasses; for effervescent drinks; for preparing tallow previously to melting it; for recovering the fatty acids from soapsuds; for destroying vegetable fibers in mixed fabrics; generally, in dyeing, calico printing, tanning, as a chemical reagent in innumerable cases; in medicine against lead poisoning, and in many other cases.

II. *In a concentrated state.* For manufacturing the fatty acids by distillation; purifying colza oil; for purifying benzene, petroleum, paraffin oil, and other mineral oils; for drying air, especially for laboratory purposes, but also for drying gases for manufacturing processes (for this, weaker acid also, of 140° Tw., can be used); for the production of ice by the rapid evaporation of water in a vacuum; for refining gold and silver, desilvering copper, etc.; for making organo-sulphonic acids; manufacturing indigo; preparing many nitro compounds and nitric ethers, especially in manufacturing nitroglycerin, pyroxylin, nitrobenzene, picric acid, and so forth.

III. *As Nordhausen fuming oil of vitriol (anhydride).* For manufacturing certain organo-sulphonic acids (in the manufacture of alizarin, eosin, indigo, etc.); for purifying ozokerite; for making shoe blacking; for bringing ordinary concentrated acid up to the highest strength as required in the manufacture of pyroxylin and other purposes.

It is of value to know the extent to which sulphuric acid is used in the more important industries in which it is employed, and an attempt has been made to ascertain this by an investigation of the data of the census of 1900. For purposes of comparison the various grades of acid occurring have been reduced to a common standard of 50° Baumé. The results of this investigation are set forth in Table 17.

TABLE 17.—*Quantity of sulphuric acid consumed for specific purposes: 1900.*

	Tons.
Total domestic production	1,548,123
Purposes for which consumed:	
Fertilizer manufacture	803,358
Petroleum refining	181,782
Pickling iron and steel	125,000
Alum manufacture	71,426
Mixed acids manufacture	63,059
Textile industry	50,000
Muriatic acid manufacture	48,750
Nitric acid manufacture	47,348
Acetic acid manufacture	17,814
Ammonium sulphate manufacture	13,908
Explosives manufacture	13,500
Blue vitriol manufacture	10,645
Epsom salt manufacture	2,773
Storage batteries	2,640
Tartaric acid manufacture	1,503
Iron liquors manufacture	1,220
Boric acid manufacture	707
Zinc sulphate manufacture	415
All other purposes	92,275

The first and largest item for the separate industries is the amount actually returned, as "materials used" and as "products consumed," by the fertilizer establishments. The second is estimated from the amounts reported[2] at the censuses of 1880, 1890, and 1905, since no report was recorded for 1900. The third is estimated from the statement of F. J. Falding,[3] in 1905, that "about 150,000 tons of 60° Baumé acid are used yearly in the iron and steel industry for pickling sheets, wire, etc., previous to galvanizing or tinning,

[1] Manufacture of Sulphuric Acid and Alkali, edition 1903, pages 1169 and 1170.

[2] Census of Manufactures, 1905, Bulletin 70, page 11.

[3] Journal of Society of Chemical Industry, 1905, vol. 25, page 403.

and this must contain less than 0.002 per cent of As." Most of the other figures were obtained by stoichiometrical calculation from the quantities of the given products returned. It has been the endeavor to make the estimates conservative and to avoid duplication. Possibly an error may exist in the item of alum, owing to the use of ammonium sulphate or of sodium sulphate from nitric or hydrochloric acid manufacture, or of natural potassium sulphate, in the manufacture of the product named, but the quantity of sulphuric acid required for the aluminum sulphate produced is large. It is to avoid duplication that certain industries, known to make use of large quantities of sulphuric acid, do not appear in the list. An example of this is found in the manufacture of dyestuffs, which is omitted, because the sulphuric acid of this industry is already accounted for in the nitric and mixed acids placed on the list. Accepting the figures of this list as fairly approximate, it appears that the sulphuric acid used in the fertilizer industry at the census of 1900 constituted 51.9 per cent of the total quantity of sulphuric acid produced in that census year. The sulphuric acid used in petroleum refining formed 11.7 per cent, and that used in pickling iron and steel 8.1 per cent, or these three industries together consumed 71.7 per cent of the total. This is lower than the estimates usually given, and may arise from the fact that in this investigation the acid of all grades has been reduced to a common basis, as the sulphuric acid used in the fertilizer industry is 50° Baumé acid, so that if the strong acid used in many other industries had not been so reduced for purposes of comparison, the acid used in the fertilizer industry would have appeared to form a larger percentage of the total.

Nitric acid.—Nitric acid, the second substance in this subclass, has been known from early times. The first description of its production, so far as is now known, appeared in 778, in the writings of Geber, who made it by distilling niter (potassium nitrate) with copper sulphate and alum. Raymond Lullius, in the thirteenth century, gave directions for making it by distilling niter with sulphate of iron. Soon afterwards Glauber obtained it by distilling niter with oil of vitriol. Nitric acid of 1.375 specific gravity, known as gilder's aqua fortis, and made by this method, sold in England in 1771 for 57 cents per pound. Nitric acid was manufactured at Philadelphia by Carter and Scattergood in 1834. It is to-day made commercially by distilling sodium nitrate with sulphuric acid, though other methods are now competing for recognition.

The quantity and value of the total amount of nitric acid manufactured, including that produced as a subsidiary product and that produced and consumed in the same establishment, was ascertained at the census of 1900, the value assigned that produced and consumed in the same establishment being the average value per unit for that reported for the acid produced for sale. Proceeding in the same way for the census of 1905, a comparison may be instituted between the returns for each census. This is shown in Table 18.

TABLE 18.—*Nitric acid—quantity and value of products: 1905 and 1900.*

	CENSUS.		Increase.	Per cent increase.
	1905	1900		
Quantity, pounds	[1] 108,380,387	[2] 63,084,722	45,295,665	71.8
Value	$5,232,527	$2,964,700	$2,267,827	76.5
Value per pound	$0.048	$0.047	....	....

[1] Includes 62,116,306 pounds, with an assigned value of $2,981,583, consumed in establishments where manufactured.
[2] Includes 32,123,221 pounds, with an assigned value of $1,509,791, consumed in establishments where manufactured.

The increase in value per pound may have arisen from the increased cost of nitrate of soda, or from the fact that a larger quantity of the higher grade acid was produced. The Census form of inquiry does not specify the different grades of nitric acid, and all of those returned are embraced in a common total in the above statistics.

In 1900 it was estimated that to produce the total amount of nitric acid reported at that census there would have been required 43,841 tons of nitrate of soda and 47,348 tons of sulphuric acid, and there would have been 52,609 tons of niter cake produced as a by-product. Using the same proportions for the returns at the census of 1905, there would have been required 75,319 tons of nitrate of soda and 81,344 tons of sulphuric acid, and there would have been produced 90,383 tons of niter cake as a by-product. These results are necessarily but approximations, because, as mentioned above, the many different commercial grades of nitric acid are all combined in the figures used, and because the different methods employed give different yields.

TABLE 19.—*Nitric acid—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	41	38
California	7	4
Colorado	1	1
Connecticut	1	2
Illinois	1	1
Indiana	3	2
Kansas	1	....
Massachusetts	3	3
Maryland	1	....
Michigan	1	1
Missouri	....	1
New Jersey	9	12
New York	4	4
Pennsylvania	6	4
Ohio	3	2
Rhode Island	....	1

Table 19 shows a total gain of 3 establishments. At both censuses New Jersey ranked first and California second. Pennsylvania, which shared the second place with California and New York in 1900, in 1905 fell to the third place, while New York became fourth.

Nitric acid is usually manufactured by heating sodium nitrate with sulphuric acid in iron retorts. The reactions taking place are probably somewhat complex,[1] but the initial and final stages may be represented by the equations:

(a) $2NaNO_3+H_2SO_4=Na_2SO_4+2HNO_3$, or

(b) $NaNO_3+H_2SO_4=NaHSO_4+HNO_3$.

If the proportions of the materials used be such that the first equation holds, the temperature which obtains must be very high in order that it may be realized, and as a consequence the nitric acid produced may be partly decomposed before it leaves the retort. This results in a diminished yield, and a product high in nitrogen oxides, and therefore discolored. Moreover, the normal sodium sulphate which remains solidifies in the retort and is difficult to remove. If, on the contrary, the proportions of the materials be those indicated in the second equation, too much sulphuric acid would be required for economic operation, unless the nitric acid works were carried on in connection with soda or muriatic acid works where the sodium hydrogen sulphate could be used in a "salt cake" furnace.

As a rule the proportions of the materials put into the retort are such as to produce a mixture of the two sodium sulphates which remains liquid at the final temperature employed, so that, after the nitric acid has been formed and distilled from the retort, the niter cake may be run off from the retort.

The sodium nitrate used is purified Chile saltpeter containing, when dried, from 98 to 99 per cent of $NaNO_3$, and should be free from sodium chloride in order that the nitric acid may not be contaminated with hydrochloric acid. The sulphuric acid used differs with the strength of the nitric acid sought. For nitric acid above 1.38 specific gravity, 66° Baumé sulphuric acid is used; but for weaker grades, sulphuric acid from the lead pan evaporation, of about 1.7 specific gravity. The size of the charge employed in different factories varies necessarily with the quantity of acid required, but charges of over 2,000 pounds of nitrate with somewhat more than an equal weight of sulphuric acid are now not uncommon.

The retorts used most commonly have been cylindrical in form. They are set in a horizontal position and partly inclosed in brickwork above a grate. More recent forms approach the shape of a short cylinder or inverted cone. They are set in a vertical position and entirely inclosed in brickwork, so that the flame may play all about them. The horizontal retorts are provided with a manhole, and the vertical with a tube, through which the molten niter cake may be run off.

A system long used for condensing the nitric acid vapors from the retort is that of passing them through a series of air-cooled earthenware Woulfe bottles, or *bombonnes*, and finally to a coke tower, fed with water or concentrated sulphuric acid to dissolve the vapors which have escaped condensation. Usually no water is placed in the Woulfe bottles unless a weak acid is required. Sometimes the Woulfe bottles are arranged in step-like positions, called *en cascade*, so that the acid vapors may enter the system in the opposite direction from that in which the condensed acid is flowing down.

Guttmann has constructed a nitric acid condensing apparatus of vertical earthenware pipes, having very thin walls, and joined at the top by 180° bends of the same material. These pipes open at the bottom into a slightly inclined collecting pipe of earthenware, which is divided by diaphragms into sections joined by U-tubes passing under the diaphragms. These diaphragms force the acid vapors to pass up one pipe and down the next in order to traverse the system. The system of pipes may be air cooled or water cooled, and thereby the acid vapors are rapidly condensed. The inventor also introduces an injector, fed with compressed air, immediately behind the exit tube from the still, and thus the nitric acid vapors are rapidly drawn off and mixed with hot air.

Hart's condensing apparatus consists of a series of superposed glass or earthenware tubes, slightly inclined to the horizontal, which starts from one vertical standpipe and ends in another. Jets of water are allowed to play upon the tubes from above, which by evaporation cools the nitric acid vapors within the inclined tubes.

In the Greisheim process a reflux cooler, consisting of a Rohrmann stoneware worm immersed in water kept at a temperature of about 60° C. by the heat of the operation itself, is placed behind the retort so that the acid vapors are partly condensed, while the nitrogen oxides pass on to a tower where they are condensed or converted and recovered. Through this modification a very pure colorless nitric acid may be made in one operation.

Rohrmann and Lunge have devised plate towers, or columns, which take the place of coke towers, and consist of large stoneware cylinders filled with perforated plates of the same material, of such form and so disposed, one above the other, as to condense and concentrate rapidly the vapors rising in the column. Such towers are not only more efficient than coke towers, but, as coke reduces nitric acid, they give better yields.

Valentiner's process is one in which a vacuum is produced in the retort and condensing apparatus during the distillation of the nitric acid.

All of these processes are in use in this country in different establishments. The results of the operation of Valentiner's apparatus, which has been installed in this country since the taking of the census of 1900, are set forth in Table 20.

[1] Journal of American Chemical Society, 1900, vol. 23, page 489.

Table 20.—RESULTS OF NITRIC ACID DISTILLATION OBTAINED WITH THE FIRST TWO VALENTINER VACUUM APPARATUS INSTALLED IN THE UNITED STATES: 1904.

DATE OF RUN.	CHARGE.						Theoretical yield in pounds of 100 per cent nitric acid (pounds).	Recovered acid as 100 per cent nitric acid (pounds).	Per cent of theory.
	Niter.		Sulphuric acid.		Nitric acid.				
	Pounds.	Per cent.	Pounds.	Per cent.	Pounds.	Per cent.			
February 27	2,175	97.7	2,466	95.8			1,574	1,559	99.0
February 29	2,200	97.3	2,466	95.6			1,587	1,609	101.3
March 1	2,200	97.3	2,466	95.6			1,587	1,537	96.8
March 2	2,200	98.5	2,560	93.5			1,605	1,596	93.4
May 7	2,200	96.3	2,430	96.0			1,569	1,544	98.4
May 8	2,200	96.3	2,400	96.0			1,569	1,554	99.0
May 12	2,200	96.3	2,383	93.5			1,569	1,565	99.7
May 13	2,200	96.3	2,383	93.5			1,569	1,553	99.1
May 14	2,319	96.3	2,475	93.5			1,657	1,649	99.5
May 16	2,200	96.3	2,383	93.5			1,569	1,538	98.1
May 17	2,200	96.3	2,383	93.5			1,569	1,564	99.7
May 18	2,200	96.3	2,465	93.5			1,569	1,551	98.9
June 4	2,200	96.8	2,600	96.0	923	71.3	2,236	2,208	98.7
June 6			1,935	96.0	2,735	79.2	2,166	2,153	99.4
June 19			2,350	93.5	2,086	62.5	1,304	1,300	99.7

The first twelve distillations were made with niter and sulphuric acid of different strengths. The thirteenth was a distillation with niter and sulphuric acid, but charging at the same time some weak and dirty nitric acid. The fourteenth and fifteenth distillations were redistillations of weak and dirty nitric acid with sulphuric acid only. Ninety per cent of the yield was obtained as nitric acid of 93 to 96 per cent, with five-tenths of 1 per cent and less of nitrous acid. By redistillation in the same apparatus, the nitric acid was purified and concentrated to a strength of 96 to 98 per cent, with less than one-tenth of 1 per cent of nitrous acid.

Although for a long time sodium nitrate has been practically the sole commercial source of nitric acid, yet in the last five years many attempts have been made to obtain it in other ways. Ostwald has sought to produce it from ammonia and air by a contact process. This would necessitate a supply of cheap ammonia in order that the manufacture may be carried on profitably. Frank proposes to make this ammonia from calcium cyanamid prepared from atmospheric nitrogen.

The atmosphere in which the earth is enveloped consists of 79.2 per cent of nitrogen and 20.8 per cent of oxygen by volume. Its depth is such that, calculating from the pressure it exerts, it is estimated that the air existing above each acre of ground contains approximately 33,880 tons of free nitrogen. Naturally many have realized what important results would follow if a means could be devised by which this nitrogen could be made to combine with the oxygen with which it is intermingled in the atmosphere. As early as 1775 Priestley noted that nitrogen compounds were formed when electric sparks were passed through the air, and not long after Cavendish produced saltpeter by absorbing air, so treated, in caustic potash solution. Although many subsequent observations along this line were made by Berthelot, Lord Rayleigh, and many others, no method for accomplishing this end which appeared in the least promising was devised until Bradley and Lovejoy were, on September 30, 1902, granted United States patents for a method and apparatus. Their process, which was tried by the Atmospheric Products Company of Niagara Falls, N. Y., consisted in producing in the air a flaming electric arc of minimum volume by the rapid rotation of electrodes carrying high tension currents. While nitric acid was thus produced, the process proved too costly, and the experiments ceased.

Since then Birkeland and Eyde have devised a process which has been put into operation at Nottoden, Norway. In their device the flaming arcs produced by high tension currents are made to move to and fro through the atmosphere in the apparatus by exposure to the attraction of powerful magnets. This apparatus is characterized by a narrow air chamber through which air is passed, and within which the electrodes, placed near together, are arranged between the poles of a strong magnet and at right angles to these poles. A disk-shaped or deflected electric arc is thus obtained perpendicular to the lines of force of the magnetic field. Three such furnaces at Nottoden, using 500 kilowatts and 5,000 volts, give deflected arcs about 3 feet in diameter. This process has been operated on a very considerable scale. According to O. N. Witt,[1] the daily production now amounts to 1,500 kilos of anhydrous nitric acid, and an output of 500 to 600 kilos of nitric acid per kilowatt year can be regularly maintained. It is evident that Witt's figures simply set forth the nitric acid content of the product actually obtained, for the weak nitric acid which is directly produced in the atmosphere about the electric discharges must be combined with a basic radical in order to be recovered. For this purpose the nitrogen compounds formed are absorbed in water in towers, the weak acid being exposed repeatedly to the nitrogen oxides until it attains a strength of 50 per cent. The

[1] Journal of Society of Chemical Industry, 1905, vol. 28, page 699.

incompletely oxidized nitrogen oxides which leave the absorption towers are passed through milk of lime and then over quicklime, and are thereby converted chiefly into calcium nitrite. This is treated with the nitric acid, through which calcium nitrate is formed and nitrous acid set free. The latter is then oxidized to nitric acid and sent to the absorption towers. The calcium nitrate has been offered in commerce for use as a fertilizer, but, as the nórmal salt is extremely deliquescent and therefore troublesome, it is now converted into the more permanent basic calcium nitrate by the addition of more quicklime or of calcium sulphate. To obtain nitric acid of merchantable strength this calcium nitrate must be distilled with sulphuric acid, but there are difficulties in the way, such as the formation of calcium sulphate that is not easily fusible. Thus far no commercial nitric acid seems to have been formed by this process.

Notwithstanding that processes for the direct production of nitric acid from atmospheric nitrogen have not yet been made commercially successful, the necessity for other sources of supply is so pressing and increasing that this problem will probably be solved before the next census.

Niter cake, the by-product of this industry, is known also as "*sal enixum*," "Sally Nixon," and "cylinder cake." Its composition approaches that of sodium hydrogen sulphate or sodium bisulphate, but it frequently carries considerable adherent sulphuric acid. It generally contains from 25 to 30 per cent of "free acid" or "bisulphate acid," calculated as SO_3, and only traces of nitrate. Much of this material has in the past been thrown on the dumps, greatly to the injury of neighboring water courses and of surrounding vegetation, but it may be utilized in many ways. By fusing it with common salt the latter reacts with the excess sulphuric acid in the niter cake to form hydrochloric acid, which distills off and leaves the residue composed entirely of salt cake. By treating phosphate rock with niter cake, superphosphate, mixed with sodium sulphate, is produced. By reaction of a solution of niter cake in water with lime water, calcium sulphate, which may be used as a pigment in paint making or as a filler in paper making, is produced, together with Glauber's salt. Other instances occur in which the excess acid in niter cake may be used in substitution for the more costly sulphuric acid, and its use is extending.

Mixed acids.—Mixed acids, produced by mixing sulphuric acid with nitric, have been used in this country on a considerable commercial scale since the gun cotton and nitroglycerin industries were established, and their use has become common in other chemical industries. The statistics of this industry were reported separately only at the census of 1900 and at the present census. By assigning to the acid reported as produced and consumed the same value per unit as that found for the acid reported as produced for sale, the comparison set forth in Table 21 may be made.

TABLE 21.—*Mixed acids—quantity and value of products: 1905 and 1900.*

	CENSUS. 1905	CENSUS. 1900	Increase.	Per cent of increase.
Quantity, pounds	[1] 140,668,959	[2] 135,610,095	5,058,864	3.7
Value	$4,142,147	$3,535,431	$606,716	17.2
Value per pound	$0.029	$0.026		

[1] Includes 75,337,632 pounds, with an assigned value of $2,184,791, consumed in establishments where manufactured; and also the mixed acids produced in establishments engaged primarily in the manufacture of other products.
[2] Includes 93,241,276 pounds, with an assigned value of $2,424,273, consumed in establishments where manufactured; and also the mixed acids produced in establishments engaged primarily in the manufacture of other products.

The data presented in Table 21 show that this industry is steadily growing and that the larger part of the material is produced in establishments in which it is consumed in further manufacture. This fact tends to make it difficult to secure complete returns of the industry, for while manufacturers' books usually show records of the materials purchased, the stock on hand, and the products sold, they often may fail to show the materials produced and consumed in further manufacture. This may explain the decrease in amount of produced and consumed mixed acids that was returned at the census of 1905 as compared with that for 1900. The decrease, however, may be but partly due to this cause, for during the period since 1900 the practice of rebuilding the spent acids for further use has been greatly extended. Hence while from the standpoint of use and of the quantity of material nitrated the quantity of mixed acids employed may have increased largely, yet as the larger portion of this rebuilt acid is used over and over again, the total quantity used in the industry may have been less.

TABLE 22.—*Mixed acids—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	32	22
California	6	3
Connecticut		1
Illinois	2	
Indiana	2	2
Kansas	1	
Massachusetts	1	4
Michigan	1	1
New Jersey	9	7
New York	7	1
Pennsylvania	1	1
Ohio	2	2

There has been an increase in the total number of establishments at the census of 1905 as compared with 1900 of 10, or 45.5 per cent. New Jersey has ranked first at both censuses, and is followed at the census of 1905 by New York and California in the order named. No other state has at this census shown more than two establishments.

Table 23 shows the distribution of this industry, based on the output of the different geographic divisions at the censuses of 1900 and 1905.

TABLE 23.—*Mixed acids—quantity of products, by geographic divisions: 1905 and 1900.*

DIVISION.	1905	1900
	Pounds.	*Pounds.*
United States	140,668,959	135,610,095
North Atlantic	96,400,122	49,834,129
North Central	29,400,758	31,055,966
Western	14,868,079	54,720,000

Although there was an increase of 46,565,993 pounds in the North Atlantic division, yet in the North Central and Western divisions there was a decrease due undoubtedly to the operation of the causes set forth above in the discussion of Table 21.

Mixed acids, as used in the various industries and for different purposes, vary in their relative contents of nitric and of sulphuric acid. As an example there may be cited the following:

Percentage composition of various mixed acids.

MANUFACTURE.	H_2SO_4.	HNO_3.
Nitroglycerin	61.9	34.5
Gun cotton	78.6	21.0
Pyrocellulose	57.0	28.2
Pyroxylin for plastics	66.0	17.0
Pyroxylin for smokeless powder	56.0	29.0

These percentages are generally approximations, and the data are given in terms of real sulphuric and nitric acids. There are other compositions used in the coal tar dye industry and other industries, but by far the largest amount is consumed in the manufacture of nitroglycerin. It may therefore be fairly assumed that the average composition of the entire quantity of mixed acid is approximately 62 per cent of H_2SO_4 and 30 per cent of nitric acid, the remainder consisting of water, nitrogen oxides, and impurities. Proceeding in this way it would appear that at the census of 1900 there were used in the making of mixed acids 63,059 tons of 50° Baumé sulphuric acid and 20,342 tons of nitric acid, and that at the census of 1905 there were used for this purpose 65,411 tons of 50° Baumé sulphuric acid and 21,100 tons of nitric acid.

Mixed acids are manufactured by mixing sulphuric and nitric acids, of the strength and in the proportions required for the purpose to which the product is to be put. The mixture takes place in iron tanks, and is promoted by stirring with paddles or with compressed air.

The method of rebuilding, or regenerating, mixed acids, which is in use at the United States Naval Smokeless Powder Factory at Indian Head, Md., has been described by G. W. Patterson.[1] At this factory the acid is used in making a cellulose nitrate which must contain 12.5 per cent of nitrogen and be soluble in a mixture of two volumes of ethyl ether and one volume of 95 per cent ethyl alcohol.

The allowed limits of variation in this product are so small that every detail in the nitrating process requires to be carefully checked and accounted for. The exact strength of the nitrating acids is most important, and every batch of acid must conform to a certain standard. The acids used for the manufacture of this grade of nitrocellulose are a mixture of approximately 56 per cent of H_2SO_4, 29 per cent of HNO_3, and 15 per cent of H_2O. With such a mixture, it is the usual practice to regenerate the spent acids by the addition of a mixture of strong sulphuric and nitric acids, this mixture being given the name of fortifying acid.

* * * All handling of mixtures of nitric and sulphuric acid is carried on in cylindrical steel tanks, connected by heavy 2½-inch pipes, one pipe for receiving acid, the other for delivering. Iron cocks on these pipes control the flow of acid. Compressed air at 20 pounds pressure is used entirely for mixing and transfer of acid. The air pipes are 1 inch in diameter, and in tanks, where mixing is done, the pipe is extended inside the tank and along its entire length just clearing the bottom. The end of the pipe is plugged and a row of holes drilled in the underside of the pipe forms an air chamber of the pipe, allowing the air to escape along its entire length simultaneously. A tank 23 feet 6 inches long and 5 feet in diameter holds conveniently 42,000 pounds of mixed acid; one 35 feet long and 6 feet in diameter holds 90,000 pounds. Each tank is provided with a 1-inch vent hole through a flange in the top. When air pressure is to be applied to the tank this hole is closed by a wooden plug.

The tanks are arranged close together in a battery, two of the 90,000-pound tanks for spent acids; 8 of the 42,000-pound tanks for mixed acid, fortifying acid, and 98 per cent sulphuric acid; one 42,000-pound tank mounted on a platform scale as a weighing tank is connected by permanent 2½-inch pipe to the other tanks, as it is found that a 15-feet lead of pipe is sufficient to prevent any influence on the weighing.

Spent acid having been collected in a tank to the amount of 85,000 to 90,000 pounds, it is mixed by blowing air through it for one hour, sampled, and carefully analyzed. The proper quantities of fortifying acid and sulphuric acid or nitric acid, as the case may be, to be added, are calculated; 34,000 pounds of the spent acid are transferred to the weighing tank, and the other necessary acids are then transferred to the weighing tank. Air pressure is now put on the weighing tank and the whole charge transferred to a mixing tank, where it is mixed one hour by blowing air. Analyses of the mixed acid invariably agree with the calculation. Two important requirements are necessary for accurate work: (1) The weighing tank must have an inside air pipe to give a preliminary mixing and to entirely clear the tank of acid; (2) If less than one-half a tank of acid is being mixed, the circulation is not so good, and a longer time is required to mix the charge, up to one hour and a half or two hours. An air pressure of 20 pounds will transfer 1,000 pounds of acid per minute.

* * * The number of times that a spent acid may be regenerated appears to be unlimited, provided the amount of N_2O_4 does not exceed the limit of 5.5 per cent. The acid at present in use in the factory has been regenerated at least 150 times and remains practically unchanged. The amount of suspended nitrocellulose in the spent acid under normal conditions is less than 0.01 per cent, while the total iron present calculated as Fe is only 0.025 per cent. During the winter months there is a slight but constant decrease in lower oxides in the spent acid, while in the summer months they increase. The nitrocellulose in suspension in mixed acids is continually decomposing, and if allowed to stand undisturbed, entirely disappears.

* * * The fortifying acid contains 44 per cent H_2SO_4, 48 to 49 per cent HNO_3, and 0.2 to 2 per cent N_2O_4, with a total acidity of 94 per cent. In preparing this acid, the precaution is taken to have a

[1] Bericht V. Internationaler Kongress für Angewandte Chemie, 1904, Vol. II, page 474.

sufficient amount of nitric acid contained, so that no nitric acid, as such, must be added to the spent acid for regeneration. It is analyzed by the same methods as are used for other mixed acids, and must contain only traces of chlorine and no metallic salts, except salts of iron. This acid is handled and treated in exactly the same way as mixed acids of less strength.

Class I. B.—Other Acids.

The subclass "other acids" includes all of the substances appearing in commerce which are styled acids by the chemist, except sulphuric, nitric, and mixed acids. At the census of 1900 the quantities and values of the hydrochloric, boric, acetic, tartaric, tannic, and gallic acids reported were set forth separately. The quantities and values of the lactic and citric acids reported were combined in the presentation, since there were less than three independent establishments reporting these products. As our industries expand and become more diversified, the number of different acids for which returns may be separately published will undoubtedly increase, for new and useful purposes to which they may be applied in the arts are frequently being discovered.

Table 24.—*"Other acids"—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	11	13	[1]2	[1]15.4
Capital	$4,857,350	$2,360,787	$2,496,563	105.8
Salaried officials, clerks, etc., number	123	69	54	78.3
Salaries	$208,316	$90,440	$117,876	130.0
Wage-earners, average number	692	446	246	55.2
Total wages	$428,989	$265,715	$163,274	61.4
Miscellaneous expenses	$203,390	$69,770	$133,620	191.5
Cost of materials used	$1,605,649	$945,955	$659,694	69.7
Value of products	$2,726,487	$1,848,348	$878,139	47.5

[1] Decrease.

From Table 24 it appears that though there has been a decrease in the number of principal establishments in this subclass, due probably to the products being more frequently manufactured in establishments where other substances having a larger value are also produced, yet in every other item there has been a marked increase. The percentage of increase in miscellaneous expenses and cost of materials has been far greater than in value of products; and the percentage of increase in salaries much greater than that in wages.

Muriatic acid.—Muriatic acid, in some respects the most important member of this subclass, has been known also as spirit of salt, chlorhydric acid, and hydrochloric acid. It is a solution of hydrogen chloride, HCl, in water, and occurs in commerce in various strengths. Basil Valentine, in the fifteenth century, was the first to describe its preparation, producing it by heating a mixture of common salt and green vitriol, although Geber, whose work was accomplished in the second half of the eighth century, made use of *aqua regia,* which is a mixture of hydrochloric and nitric acids. It is a curious point in chemical history that muriatic acid, which at present is so cheap, and which has at times been considered almost worthless, was in Glauber's time (1604 to 1668) the most costly of the mineral acids.[1]

The condition of the muriatic acid industry as such is ascertained by combining the returns from all establishments in which it was manufactured either as a principal or subsidiary product together with the figures for that consumed in further manufacture, the latter being given the same value per unit as was found for the former. The results are set forth in Table 25.

Table 25.—*Muriatic acid—quantity and value of products: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Quantity, pounds	[1]188,538,396	[2]134,229,012	54,309,384	40.5
Value	$1,730,231	$1,173,900	$556,331	47.4
Value per pound	$0.009	$0.009		

[1] Includes 61,035,714 pounds, with an assigned value of $549,321, consumed in establishments where manufactured; and also the muriatic acid produced in establishments engaged primarily in the manufacture of other products.

[2] Includes 17,553,903 pounds, with an assigned value of $157,985, consumed in establishments where manufactured; and also the muriatic acid produced in establishments engaged primarily in the manufacture of other products.

The marked increase shown in the amount produced and consumed indicates that in this industry, as in those previously discussed, there is a healthy tendency to realize the profit which accrues from further elaboration of the products of a chemical industry.

The quantity of muriatic acid given in the table includes all grades. The ordinary muriatic acid of commerce contains 40 per cent by weight of dry hydrogen chloride. Assuming the entire product reported in 1900 to be of this grade, there would have been required for its production about 41,427 tons of common salt and 54,582 tons of 50° Baumé sulphuric acid, while there would have been produced 52,624 tons of salt cake. For the quantity returned in 1905 there would have been required 59,700 tons of salt and 78,659 tons of 50° Baumé sulphuric acid, while there would have been 75,836 tons of salt cake produced. The above calculation is based on the further assumption that the acid was produced entirely by the action of sulphuric acid on common salt, for if niter cake were used with the common salt it would not only replace the sulphuric acid, but also a part of the salt required for the production of the quantity of salt cake desired. No definite information is at hand as to the extent to which niter cake is used in this industry, but there are indications which suggest that upward of 20 per cent of the common salt may be thus replaced, and of course a lesser amount of sulphuric acid.

[1] E. von Meyer, History of Chemistry, 1891, page 507.

Table 26.—*Muriatic acid—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1] 36	[2] 31
California	4	3
Colorado	1	1
Connecticut	....	1
Illinois	1	3
Indiana	1	2
Kansas	1	....
Maryland	1	....
Massachusetts	3	2
Michigan	3	1
Missouri	....	1
New Jersey	5	6
New York	5	4
Pennsylvania	9	5
Ohio	2	2

[1] Includes 25 establishments engaged primarily in the manufacture of other products.
[2] Includes 18 establishments engaged primarily in the manufacture of other products.

From Table 26 it appears that there has been an increase of 5 in the number of establishments, or 16.1 per cent. Pennsylvania, which was second in rank in 1900, passes to the first place, while New York, which was third, now shares second place with New Jersey, which was first in 1900. California now ranks third. No other of the states reports more than 3 establishments.

Table 27 shows the geographic distribution of the industry according to the quantity of the output at the censuses of 1900 and 1905.

Table 27.—*Muriatic acid—quantity of products, by geographic divisions: 1905 and 1900.*

DIVISION.	1905	1900
	Pounds.	*Pounds.*
United States	188,538,396	134,229,012
North Atlantic and South Atlantic	121,125,924	89,257,974
North Central	61,861,453	37,495,038
Western	5,551,019	7,476,000

From Table 27 it appears that there has been an increase in every one of the divisions presented except in the Western. There appears no evident cause for this exception.

Muriatic acid is manufactured by heating common salt with sulphuric acid or with niter cake. The roasting is carried on in salt cake furnaces of either the form known as the "open roaster," which consists of a cast-iron pan and a reverberatory hearth, or the "closed roaster," in which the pan and hearth are inclosed in a brick or fire clay muffle in order to prevent the soot and dust from the fire reaching the acid vapors and mingling with them. During the second stage of the process, when sulphuric acid is used, or throughout it, when niter cake is used, the charge must be constantly stirred to prevent "crusting," or adhering to the hearth. This has been accomplished by the use of a "rabble" worked by hand, but in the more modern Mactear furnace it is effected by a mechanical device. The acid vapors are absorbed in water. Formerly, and to-day still to some extent, this was done by the passage of the vapors through Woulfe bottles, placed *en cascade* and leading to a coke tower. The Lunge-Rohrmann plate tower will largely replace both, especially when combined with long cooling pipes exposed to the air, so that the vapors may be cooled before coming in contact with the water. A recent device for absorbing the vapors is found in the Cellarius tourill, or jar.

The results of a year's run with air cooling, using salt containing from 97 to 98 per cent of sodium chloride, is shown in Table 28.

Table 28.—*Muriatic acid produced with Cellarius jars during a twelve months' run.*

MONTH.	Salt (pounds).	20° acid produced (pounds).	Yield per 100 pounds of salt.
September	205,926	431,992	209.8
October	229,416	456,156	198.8
November	215,309	397,370	184.6
December	213,688	412,660	193.1
January	250,654	490,490	195.7
February	197,802	390,337	197.3
March	187,160	355,605	190.0
April	101,560	190,740	187.8
May	245,858	469,396	190.9
June	226,311	442,054	195.3
July	210,080	405,556	193.0
August	218,196	416,699	191.0

Acetic acid.—Acetic acid, as considered in the census returns, does not include the dilute acetic acid, produced by the fermentation of diluted alcoholic liquids or by the oxidation of alcohol, and known as vinegar. The grades of acetic acid found in commerce contain from 28 to 90 per cent of real acetic acid, and, unlike the other liquid acids in commerce, it is graded by its real acetic acid contents instead of by its specific gravity, because a 50 per cent solution of acetic acid possesses about the same specific gravity as anhydrous acetic acid.

This acid, in the form of vinegar, was known to the ancients. It is mentioned by Moses in Numbers vi, 3. Hippocrates employed it in medicine. Hannibal is said to have softened rock by fire and vinegar during his passage over the Alps. Acetic acid in its more concentrated form was known to Geber and to Stahl as being produced by the distillation of verdigris, which is an acetate of copper. It is to-day made by distilling brown or gray acetate of lime with concentrated muriatic acid, or sodium acetate with sulphuric acid.

Table 29.—*Acetic acid—quantity and value of products: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Quantity, pounds	[1] 29,506,021	[2] 27,875,222	1,630,799	5.9
Value	$597,235	$446,326	$150,909	33.8
Value per pound	$0.02	$0.016	....	....

[1] Includes 2,431,741 pounds, with an assigned value of $28,635, consumed in establishments where manufactured; and also acetic acid produced in establishments engaged primarily in the manufacture of other products.
[2] Includes 1,214,667 pounds, with an assigned value of $19,434, consumed in establishments where manufactured; and also acetic acid produced in establishments engaged primarily in the manufacture of other products.

This comparison shows that the acetic acid industry is characterized by the same tendency as that pointed out in industries already presented, for while the increase in the total quantity of acetic acid is but 5.9 per cent, the increase in that produced and consumed is 100.2 per cent.

TABLE 30.—*Acetic acid—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	12	14
Illinois		2
Maryland	1	
Massachusetts	[illegible]	2
Missouri		2
New Jersey	5	2
New York	1	3
Pennsylvania	[illegible]	3

From Table 30 it appears that the number of establishments returned as producing acetic acid was smaller by 2 in 1905 than in 1900. Nevertheless both the quantity and value of the product for 1905 were larger than for 1900.

All other acids.—Table 31 contains the returns for all acids not already presented, by quantity and value, for the censuses of 1905 and 1900.

TABLE 31.—*Minor acids—number of establishments and quantity and value of products: 1905 and 1900.*

ACID.	1905			1900		
	Number of establishments.	Quantity (pounds).	Value.	Number of establishments.	Quantity (pounds).	Value.
Boric	7	6,956,896	$527,190	[illegible]	2,684,935	$198,212
Citric	4	2,265,631	598,718	[1] 3	[1] 3,886,382	[1] 335,297
Hydrofluoric	6	2,932,358	151,218	4	698,000	34,890
Lactic	3	2,906,555	158,911	(2)	(2)	(2)
Phosphoric	9	991,050	68,541	(3)	(3)	(3)
Pyroligneous	5	11,240	1,432	(4)	(4)	(4)
Tannic	[illegible]	715,500	195,136	5	282,515	135,662
Other acids [5]	7		975,551	11		1,151,819

[1] Includes lactic.
[2] Included in citric.
[3] Less than 3 establishments; included in "other acids."
[4] None reported.
[5] Includes gallic, salicylic, stearic, and tartaric acids in 1905 and 1900, and phosphoric and oleic acids in 1900.

The figures of Table 31 are only for acids produced for sale and do not include such as were consumed where produced.

The statistics for acids imported from 1891 to 1905 are given in Table 32. The data have been compiled from Commerce and Navigation of the United States, published by the Bureau of Statistics.

TABLE 32.—ACIDS—IMPORTS FOR CONSUMPTION: 1891 TO 1905.

YEAR ENDING JUNE 30—	SULPHURIC ACID, OR OIL OF VITRIOL (N. E. S.).[1]		SULPHURIC ACID.[1]		BORACIC ACID.						CHROMIC ACID.		CHROMIC AND LACTIC ACID.	
					Commercial.		Pure.		All kinds.					
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1891	15,377	$836			152,093	$7,975	39,394	$2,906	475,378	$30,138		$1,587		
											506	155		
1892	8,277	478	8,735	$339					701,625	39,418	426	156		
1893	634	43	8,735	1,033					771,775	40,568	3,318	[illegible]		
1894	17,053	405	400	32					292,900	19,282	5,048	824		
1895	12,574	186	7,459	461					925,154	42,056	4,461	707		
1896	36,798	475	48,759	1,606					555,769	21,899	2,440	409		
1897	3,200	43	59,729	4,074					548,603	19,494	2,708	430		
1898	25,350	786	2,725	40	134,707	4,053	244,073	7,994		45,265	6,720	906	64,066	$4,917
1899	40,175	1,874					436,958	14,303		56,428			23,969	4,843
1900	34,944	972					466,879	17,467		53,625			34,741	6,044
1901	77,492	2,312	1,628	23					648,994	23,485			46,993	9,881
1902	132,491	2,427							795,024	29,779			58,782	10,860
1903	307,687	4,317							783,987	29,651			84,918	8,339
1904	63,400	1,383	4,480	51					721,532	29,651			82,900	9,184
1905	288,630	4,145	570	6					660,150	23,626			68,732	8,481

YEAR ENDING JUNE 30—	CITRIC ACID.		TARTARIC ACID.		OXALIC ACID.		SALICYLIC ACID.		TANNIC ACID OR TANNIN.		ALL OTHER ACIDS.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1891	45,197	$15,482	1,511	$468	2,743,222	$200,595			659	$239	1,350,710	$380,054
1892	80,034	27,461	10	5	2,209,940	150,529			564	216	1,024,580	347,510
1893	13,315	4,633	130	39	2,464,443	143,194	260,027	$254,022	1,443	597	685,677	175,637
1894	5,502	1,810	113	32	2,783,876	159,026	252,332	231,946	794	287	835,215	134,665
1895	8,895	2,480	355	88	2,889,513	189,506	196,974	140,197	1,500	597	1,798,417	228,430
1896	39,671	12,521	212	66	3,164,969	219,630	335,354	138,013	1,745	681	1,027,235	240,522
1897	73,133	18,158	225	71	3,602,124	246,200	616,187	201,980	3,144	1,296	3,040,325	223,458
1898	4,323	1,108	455	128	3,747,041	242,276	92,943	28,688	2,335	927		45,265
1899	65,190	16,659	23,298	5,737	3,981,768	246,027	185,358	57,192	3,697	1,371		56,428
1900	60,354	14,213	954	252	4,990,123	275,747	240,687	89,175	1,415	671		53,625
1901	76,805	23,038	1,068	299	5,622,909	300,879	222,270	76,786	2,007	1,092		42,838
1902	74,712	21,085	1,483	377	5,678,139	301,675	219,127	57,852	1,938	1,116		61,286
1903	12,338	3,544	5,950	1,482	5,363,646	257,289	78,266	19,012	1,847	918		27,026
1904	5,546	1,461	849	215	6,726,159	329,836	32,759	7,305	5,855	2,829		23,793
1905	2,778	728	446	132	7,906,886	360,951	7,455	2,302	7,652	3,108		37,404

[1] From the value given, this would appear to be fuming sulphuric acid.

BIBLIOGRAPHY.

DIVERS, E. *Raschig's Theory of the Lead-chamber Process*, Journal of Society of Chemical Industry, 1904, vol. 23, page 1175.

DUNN, J. T. *The Life and Work of John Glover, Inventor of the Glover Tower*, Journal of Society of Chemical Industry, 1903, vol. 22, page 1181.

FALDING, F. J. *Progress in the Sulphuric Acid Industry during 1901–1902*, Mineral Industry, 1902, Vol. X, page 599; 1903, Vol. XI, page 580.

—— *Sulphuric Acid, Review of Progress in the United States since 1900*, Bericht V. Internationaler Kongress für angewandte Chemie, 1904, Vol. I, page 768.

—— *The Substitution of Pyrites for Brimstone in the Manufacture of Sulphite Pulp*, Journal of Society of Chemical Industry, 1906, vol. 25, page 403.

FERGUSON, W. C. *Description of Methods Employed in Preparing the Tables of Specific Gravity of Sulphuric Acid, Nitric Acid, Hydrochloric Acid, and Ammonia Adopted by the Manufacturing Chemists' Association of the United States*, Journal of Society of Chemical Industry, 1905, vol. 24, page 781.

FRANKLAND, PERCY F. *The Utilization of Atmospheric Nitrogen for Industrial Purposes*, Journal of Society of Chemical Industry, 1907, vol. 26, page 175.

FRAZER, PERSIFOR. *Search for the Causes of Injury to Vegetation in an Urban Village Near a Large Industrial Establishment*, Bimonthly Bulletin American Institute of Mining Engineers, No. 15, pages 377 to 398, May, 1907.

—— *Bibliography of Injuries to Vegetation by Furnace Gases*, Bimonthly Bulletin American Institute of Mining Engineers, No. 15, pages 399 to 434, May, 1907.

GUTTMANN, OSCAR. *The early Manufacture of Sulphuric and Nitric Acid*, Journal of Society Chemical Industry, 1901, vol. 20, pages 5 to 8.

—— *Progress in the Manufacture of Sulphuric Acid, and its Effect*, Journal of Society of Chemical Industry, 1903, vol. 22, page 1331.

GUYE, PHILLIPPE A. *The Electrochemical Problem of the Fixation of Nitrogen*, Journal of Society of Chemical Industry, 1906, vol. 25, page 567.

HARDWICK, W. ROSCOE. *The Manufacture of Sulphuric Acid from Arsenical Pyrites*, Journal of Society of Chemical Industry, 1904, vol. 23, page 218.

HOWLES, F. *The Electro-thermic Combustion of Atmospheric Nitrogen*, Journal of Society of Chemical Industry, vol. 26, 290 to 298; April 15, 1907.

INGLIS, J. K. H. *The Loss of Nitre in the Chamber Process*, Journal of Society of Chemical Industry, 1904, vol. 23, page 643, and 1906, vol. 25, page 140.

KESTNER, PAUL. *Artificial Draught in Vitriol Chambers and the use of Atomized Water instead of Steam*, Journal of Society of Chemical Industry, 1903, vol. 22, page 333.

—— *On the use of Automatic Acid Elevators for Feeding Glover and Gay Lussac Towers*, Journal of Society of Chemical Industry, 1903, vol. 22, page 337.

LUNGE, GEORGE. *A Theoretical and Practical Treatise on the Manufacture of Sulphuric Acid and Alkali*, 1903, vol. 1, Parts I and II, Sulphuric Acid, third edition, revised and enlarged, London.

—— *Theory of the Chamber Process*, Zeitschrift für angewandte Chemie, 1904, vol. 17, page 1659.

—— *and* POLLITT, G. P. *Formation of Sulphur Trioxide by the Contact Action of Ferric Oxide*, Journal of Society of Chemical Industry, 1903, vol. 22, page 79.

MEYER, FRANZ. *History and Commercial Development of the Schroeder Contact Process of Sulphuric Acid Manufacture*, Journal of Society of Chemical Industry, 1903, vol. 22, page 348.

MEYER, THEODOR. *The Tangent System of Sulphuric Acid Manufacture*, Translated and edited by C. Glaser, Baltimore, Maryland.

PATTERSON, G. W. *Mixed Acids for Nitrocellulose Manufacture*, Bericht V. Internationaler Kongress für angewandte Chemie, 1904, vol. 2, page 474.

RASCHIG, F. *Theory of the Chamber Process*, Zeitschrift für angewandte Chemie, 1904, vol. 17, pages 1398 and 1777.

REESE, CHARLES L. *Experimental Investigations and Observations on the Schroeder Contact Process of Sulphuric Acid Manufacture*, Journal of Society of Chemical Industry, 1903, vol. 22, page 351.

SPECIAL CONSULAR REPORTS. *Acetic Acid in Foreign Countries*, 1900, vol. 22, Part I.

STONE, GEORGE C. *Manufacturing by the Schroeder Contact Process of Sulphuric Acid Manufacture*, Journal of Society of Chemical Industry, 1903, vol. 22, page 350.

WILKE, WM. *The Contact Process for Manufacturing Sulphuric Acid of the Verein Chemischer Fabriken in Mannheim*, Journal of Society of Chemical Industry, 1906, vol. 25, page 4.

CLASS II.—SODAS.

This class comprises soda ash, including white alkali and refined alkali; sal soda, including natural soda, mild mineral alkali, soda crystals, washing soda, and crystallized sodium carbonate; bicarbonate of soda, including bread soda, saleratus, sodium bicarbonate, and sodium hydrogen carbonate; caustic soda, including soda lye and sodium hydroxide; and borax, including borax glass, lime and sodium borates, and sodium biborate. Salt cake, or anhydrous sodium sulphate, and sodium silicate may be included here when products of a soda establishment. In addition to the original establishments, there are those in which soda ash is converted into sal soda and bicarbonate of soda, and those of the compounders or packers who give an added value to soda lye or the carbonate.

The term "soda" has acquired in use a variety of meanings. In the laboratory the term has been used in the past to designate the sodium oxide or hydroxide. In technology it has long been used to designate the normal sodium carbonate; yet the mixture of normal and acid carbonates found in nature is styled natural soda, and the industry in which soda ash, normal and acid sodium carbonates, and caustic soda are manufactured is called the soda industry.

Soda was known to the ancients and was used by them in making glass. They may have obtained it in the form of natural soda, for this exists in the waters of many lakes or in the residues from them. Up to a recent date[1] 5,000 tons of natural soda have been exported annually from Alexandria, Egypt. Or they may have obtained it by extracting the ash of seaweeds and marine plants with water and evaporating to dryness. These remained the only sources of soda until the latter part of the eighteenth century, when Le Blanc, stimulated by a prize offered by the French Academy about 1775, followed out the proposal of Duhamel de Monceau to prepare soda from common salt. This he accomplished by acting upon the salt with sulphuric acid, obtaining hydrochloric acid and sodium sulphate, and then converting the sodium sulphate into carbonate by fusing it with lime and coal. This process became established on a sound commercial footing when introduced into England by Losh in 1814.

[1] Wagner's Manual of Chemical Technology, 1892, page 309.

At the time the Le Blanc process was before the French tribunal, it was placed in competition with a process offered by Fresnel, which was based on the reaction taking place when a solution of common salt is brought in contact with a solution of ammonium carbonate, by which sodium hydrogen carbonate, or bicarbonate of soda, and ammonium chloride are formed; but Fresnel's process was rejected because at that time no method for the recovery of ammonia was known. It was revived by H. G. Dyar and J. Hemming in England, about 1838, and was tested on a considerable scale, but failed of success because of mechanical difficulties. These were finally overcome by Ernest Solvay, a Belgian, who made the process a commercial success in 1863. To-day the Le Blanc and Solvay processes are the chief sources of soda, though some is made from cryolite, and caustic soda is obtained in the electrolysis of common salt.

Saleratus, which is bicarbonate of soda, was reported at the census of 1860 as being manufactured in this country in 11 establishments, the product having a value of $1,176,000. For 1870, 4 establishments were returned, with a product valued at $231,647. At the census of 1880 and at each subsequent census the statistics for soda products have been made a feature in the special report on chemicals and allied products.

Table 33 shows an actual increase for 1905 over 1900 in every item. The increases in capital and value of products were especially noteworthy, being over $7,000,000 in each case, while the increase in value of products was more than double that in cost of materials. The largest proportional increase was in miscellaneous expenses, while the next largest was in number of salaried officials.

TABLE 33.—*Sodas—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	39	38	1	2.6
Capital	$22,728,369	$14,951,960	$7,776,409	52.0
Salaried officials, clerks, etc., number	784	370	414	111.9
Salaries	$1,046,891	$521,492	$525,399	100.7
Wage-earners, average number	5,981	5,788	193	3.3
Total wages	$3,310,216	$2,503,203	$807,013	32.2
Miscellaneous expenses	$2,150,469	$979,759	$1,170,710	119.5
Cost of materials used	$8,255,037	$5,331,823	$2,923,214	54.8
Value of products	[1]$18,466,504	[1]$11,073,406	$7,393,098	66.8

[1] Includes "all other products."

Table 34 shows that from 1880 on there has been a steady growth in both the quantity and value of the sodas produced. The percentage of increase in quantity was, up to 1905, greater than that in value, but at the present census this condition was reversed. In the figures for 1905 and 1900 borax and "all other products" were omitted from the list in order to make the statistics fairly comparable with those for the earlier censuses.

TABLE 34.—*Sodas—quantity and value, with per cent of increase: 1880 to 1905.*

CENSUS.	Number of establishments.	Quantity (tons).	Value.	PER CENT OF INCREASE.	
				Quantity.	Value.
1905	[1]63	734,209	$13,357,983	14.8	30.5
1900	[1]50	639,541	10,237,944	284.0	88.5
1890	32	166,562	5,432,400	727.4	526.9
1880	3	20,130	866,560		

[1] Includes establishments engaged primarily in the manufacture of other products.

TABLE 35.—SODAS—QUANTITY AND VALUE OF PRODUCTS, WITH AMOUNT AND PER CENT OF INCREASE: 1890 TO 1905.

KIND.	CENSUS.			INCREASE.		PER CENT OF INCREASE.	
	1905	1900	1890	1900 to 1905	1890 to 1905	1900 to 1905	1890 to 1905
Total:							
Tons	734,209	639,541	166,562	94,668	567,647	14.8	340.8
Value	$13,357,983	$10,237,944	$5,432,400	$3,120,039	$7,925,583	30.5	145.9
Bicarbonate of soda:							
Tons	68,867	68,856	30,339	11	38,528	([1])	127.0
Value	$1,135,610	$1,332,765	$2,009,800	[2]$197,155	[2]$874,190	[2]14.8	[2]43.5
Caustic soda:							
Tons	86,840	166,783	16,501	[2]79,943	70,339	[2]47.9	426.3
Value	$3,185,959	$3,170,280	$661,114	$15,679	$2,524,845	0.5	381.9
Sal soda:							
Tons	59,548	63,249	72,322	[2]3,701	[2]12,774	[2]5.9	[2]17.7
Value	$831,869	$875,243	$1,581,766	[2]$43,374	[2]$749,897	[2]5.0	[2]47.4
Soda ash:							
Tons	518,954	390,603	47,400	128,351	471,554	32.9	994.8
Value	$8,204,545	$4,859,656	$1,179,720	$3,344,889	$7,024,825	68.8	595.5

[1] Less than one-tenth of 1 per cent.

[2] Decrease.

The figures of Table 35 show that while there was an increase in the total quantity and value of sodas produced at each census as compared with the previous one, there was at the census of 1900, as compared with that of 1890, a decrease in the total value of the bicarbonate of soda and also in the quantity and value of the sal soda. At the census of 1905 there was a decrease in the value of the bicarbonate of soda, and in both the quantity and value of the sal soda. These decreases are largely due to the increased use of these

substances in the establishments in which they are produced. In such a summary as Table 35, if the produced and consumed products were included, the figures would be duplicated, for the other sodas are as a rule produced from the bicarbonate or the soda ash. Therefore, with the increased practice of soapmakers, wood pulp manufacturers, and others of causticizing soda ash and using the caustic soda produced in the manufacture of soap or wood fiber, the quantity produced for sale would be likely to be reduced. As explained in the report for 1900, the decrease in the production of sal soda is due to the increasing use of soap powders and other specially prepared washing materials.

At the census of 1890 sodas manufactured from natural soda were reported to the amount of 10,964,390 pounds, having a value of $124,783; and at the census of 1900, 20,420,000 pounds, valued at $106,600. At the census of 1905 the number of establishments reporting was not sufficient to permit of the statistics being published separately, but they are incorporated with soda ash in the data of Tables 36 and 37 for each census enumerated.

At the census of 1900, 7 establishments reported a product of 11,756,000 pounds of borax, having a value of $541,160. At the census of 1905, 7 establishments reported 41,764,000 pounds of borax, having a value of $2,122,808. This does not include the borax which was produced and consumed in the same establishments in the further manufacture of boric acid or other products.

TABLE 36.—*Sodas—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	63	[1] 55
California	6	6
Colorado	1	......
Illinois	4	4
Indiana	3	2
Kansas	1	......
Maryland	1	1
Massachusetts	3	1
Michigan	5	3
Missouri	2	2
Montana	1	......
New Jersey	7	3
New York	9	12
Nevada	2	5
Ohio	4	1
Pennsylvania	8	9
Rhode Island	......	1
Virginia	1	1
Wisconsin	4	4
Wyoming	1	......

[1] Includes 5 establishments producing "soda products," but no "sodas."

From Table 36 it appears that at the census of 1905 as compared with the census of 1900, the establishments of the soda industry have increased 8 in number, or 14.5 per cent. The relative positions of New York and Pennsylvania remained unchanged in 1905, the former still ranking first and the latter second among the states. New Jersey, however, advanced from seventh to third place, with California fourth and Michigan fifth. No other state or territory reported as many as 5 establishments in 1905.

TABLE 37.—*Sodas—value of products, by geographic divisions: 1905 and 1900.*

DIVISION.	1905	1900
United States	[1] $19,785,385	[1] $10,922,536
North Atlantic and South Atlantic	10,512,852	6,559,295
North Central	8,745,382	3,694,436
Western	527,151	668,805

[1] Includes products other than sodas reported by establishments engaged primarily in this industry; and also the sodas produced by establishments engaged primarily in the manufacture of other products.

The figures of Table 37 show an increase in the value of sodas in all divisions shown except in the Western, the greatest increase being in the North Central. The decrease shown in the Western division can not be accounted for except perhaps by the fact of the existence of small establishments working natural soda or borax deposits as neighborhood industries, which would not under the rule be included in the establishments enumerated at the last census.

Up to the date of the commercial success of the Le Blanc process for making soda, potash, or "vegetable alkali," was much cheaper and more largely used than soda, or "mineral alkali." Since the development of the Le Blanc process the reverse has held true. Singularly, notwithstanding that the United States has been a large consumer of sodas, and that muriatic acid, and, on further treatment, chlorine and bleaching powder, are side products of the Le Blanc process, it never secured a firm foothold in this country.

The ammonia-soda process, on the other hand, has become a factor in our industries. The first to experiment with this process in the United States were Herman and Hans Frasch, who located a plant at Bay City, Mich., about 1880, but the enterprise was not a success and the plant was abandoned some two or three years later. In 1881 the Solvay Process Company, of Solvay, near Syracuse, N. Y., and Delray, near Detroit, Mich., was organized under the laws of the state of New York. According to Pennock,[1] the following plants in the United States were in 1900 engaged in manufacturing sodas by chemical methods as distinguished from electrolytic methods: The Solvay Process Company at Syracuse, N. Y., and Detroit, Mich.; the Michigan Alkali Company at Wyandotte, Mich.; the Mathiesson Alkali Company at Saltville, Va.; and the Pennsylvania Salt Company at Natrona, Pa. Between 1900 and 1903 the plant of the Columbia Chemical Company was installed at Barberton, Ohio, and the Frasch process at Cleveland, Ohio. All of these plants used the ammonia-soda process except the Pennsylvania Salt Company, which produced its sodas from cryolite.

In the operation of the ammonia-soda process a purified and concentrated salt brine is saturated with ammonia. This brine is then sent through iron

[1] Bericht V. Internationaler Kongress für Angewandte Chemie, 1904, vol. 1, page 661.

towers, where it encounters carbon dioxide gas, resulting in the formation of bicarbonate of soda, which separates out in crystals, while the liquid containing the ammonium chloride formed by the reaction, together with some ammonium carbonate and the residue in the brine, passes on and is collected for subsequent use.

The bicarbonate of soda, after wringing and washing in a centrifuge, is dried in an atmosphere of carbon dioxide and may be sold as bicarbonate, or it is calcined and converted into soda ash. When the soda ash is dissolved in warm water and the hot solution is allowed to stand until all sediment is deposited, large crystals of quite pure sal soda will be deposited as the solution cools. If the soda ash solution be treated with lime water, calcium carbonate will be formed and precipitated, while sodium hydroxide or caustic soda will remain in solution and may be obtained as a solid by evaporation of the solution. In the Hewitt and Mond, or Loewig's process the soda ash may be fused with iron oxide forming sodium ferrate, which is easily decomposed by warm water into caustic soda and ferric oxide. Pure iron ore or pyrites cinder may be used in this process.

Since the common salt used in the ammonia-soda process must be in solution, natural brine supplies this requirement in the most economical way. By reference to the bulletin on salt it will be noticed that most of the establishments cited above from Pennock's article are located near salt deposits, where natural salt brine, or that formed by sinking shafts to salt deposits and dissolving the salt in place, is cheaply obtained.

Since ammonia is so largely used in this industry, soda works are frequently operated in conjunction with by-product coke ovens. Much of the combined and free ammonia in the liquid running off from the bicarbonate of soda crystals in the carbonating tower is, however, recovered for further use by heating the liquid alone or with lime. Such repeated utilization must be taken into account in any attempt to estimate the quantity of ammonia used in this industry.

The carbon dioxide used for carbonating is originally obtained by calcining limestone, but much of it is recovered when calcining the bicarbonate of soda to soda ash, and from the treatment of the ammoniacal solution from the carbonating tower. Carbon dioxide might be obtained from the burning of coke or coal, but as quicklime is needed both in caustic soda manufacture and in the ammonia recovery process, it is necessary to calcine limestone.

The lime is recovered partly in a salable condition, either as crystallized calcium sulphate, used as a filler in paper making and for weighting cloth, under the names of "crown filler" and "pearl hardening," or as calcium chloride, which is used in the brine tanks of ice machines.

In his address[1] before the Congress of Applied Chemistry, Ernest Solvay reviewed the history of the soda industry and presented the data for the total production of sodas from 1850 to 1902, set forth in Table 38, but with the metric tons converted into short tons and the francs into dollars.

TABLE 38.—*World's production of sodas: 1850 to 1902.*

YEARS.	Total quantity produced (tons).	Produced by the Le Blanc process (tons).	Produced by the ammonia process (tons).	Average selling price per ton taken at the factory in Europe.
1850	165,345	165,345		$135.10
1863	330,690	330,690		86.85
1864 to 1868	413,363	412,260	331	77.20
1869 to 1873	496,035	492,728	2,865	54.04
1874 to 1878	578,708	545,639	33,069	54.04
1879 to 1883	744,053	600,754	149,913	32.81
1884 to 1888	881,000	479,501	402,340	23.16
1889 to 1893	1,127,653	429,897	697,756	22.20
1894 to 1898	1,377,875	492,109	1,085,765	21.23
1902	1,940,048	165,345	1,744,703	21.23

Thorp describes the manufacture of sodas by the cryolite process as follows:[2]

The ground cryolite is mixed with powdered limestone, and calcined at a red heat. Carbon dioxide escapes, and a mixture of calcium fluoride, sodium oxide, and sodium aluminate remains. On lixiviating this mixture with water another sodium aluminate is formed and goes into solution, leaving the calcium fluoride as an insoluble residue. The solution of sodium aluminate is then decomposed according to the third reaction, by passing into it purified limekiln gases, or the furnace gases of the calcining operation. Hydrated alumina is precipitated, while sodium carbonate remains in solution. Sal soda may be made by evaporating the solution, and was formerly the chief source of bicarbonate for culinary and medicinal purposes. If carried to complete dryness and calcined, a high grade of soda ash is obtained. By causticizing, it yields a very excellent caustic.

The by-products aluminum hydroxide and calcium fluoride are used in the alum and glass industries, respectively.

Soda ash appears in the market as 58 per cent, dense 58 per cent, 48 per cent, special 48 per cent, and 36 per cent; caustic soda, as high test 76 per cent, 74 per cent, 70 per cent, special 70 per cent, 60 per cent, and special 60 per cent; soda crystals, as monohydrate crystals, 49.8 per cent, and snow flake crystals, 40.9 per cent; and bicarbonate of soda, as pure bicarbonate, 99 per cent, for baking soda, and anchor dust, which is an inferior grade used as a source of carbon dioxide in charging "soda water." The percentages refer to the Na_2O contents in each case except that of the bicarbonate, where it refers to $NaCO_3$. In the census returns no cognizance is taken of these many grades, so that the figures given for any item in the tables are the gross amount for all grades.

Sodas are used in glassmaking. Thus at the census of 1890[3] there were reported as used by this industry 96,777 tons of soda ash and 38,092 tons of salt cake; at the census of 1900, 157,779 tons of soda ash and 53,257 tons of salt cake; and at the census of 1905,[4]

[1] Bericht V. Internationaler Kongress für Angewandte Chemie, 1904, vol. 1, page 108.

[2] Outlines of Industrial Chemistry, 1905, page 96.

[3] Twelfth Census, Manufactures, Part III, page 983.

[4] Census of Manufactures, 1905, Bulletin 57, page 46.

215,462 tons of soda ash. They are used in soapmaking, 53,777 tons of soda ash and 71,551 tons of caustic soda, having been reported as used in this industry at the census of 1905.[1] Soda ash, caustic soda, and salt cake are used in the treatment of wood in the manufacture of wood fiber. The statistics of consumption are not at hand, but at the census of 1900,[2] 94,042 tons, and at the census of 1905,[3] 120,978 tons of soda wood fiber were reported as having been purchased for use in paper making. According to Griffin and Little,[4] with indirect steam in rotaries, about 700 gallons of a liquor, containing from 6 to 9 per cent of NaOH, are used to a cord of wood, while upright digesters require considerably more. As the liquors from the digesters are treated so as to recover their soda contents for further use, it is difficult to estimate the quantity of sodas actually used in the wood pulp industry, but it is large. There is a great variety of other uses to which sodas are put, but the three industries named are the largest consumers.

The natural soda industry was described with much detail in the special report on chemicals and allied products at the census of 1900.

The borax industry is closely associated with the natural soda industry since both substances, or at least boron compounds from which borax may be obtained, are found as residues in arid regions. In fact, deposits of a mixture of natural soda, common salt, and borax are known in California as "borax beds." According to Bailey[5] borax was first discovered in the United States on January 8, 1856, by Dr. John A. Veatch, on evaporating water from the Tuscan springs, Tehama county, Cal. Bailey describes the development of the industry as follows:

California in 1849 started the gold mining industry in the United States, and fifteen years later followed it with the establishment of the borax industry. The 12 tons made at Borax Lake, on the margin of Clear Lake, in Lake county, were the first produced on the American continent.

The young industry thrived for the next four years, although the maximum output of 220 tons in one year would seem small now.

The next three years, 1869, 1870, and 1871, were dark years for those watching the growth of the youngster, for the supply of the pure crystals in the blue mud of the famous little lake had given out, and an unruly artesian well had ruined the waters of the lake by diluting them beyond the profit point.

The deposits of Lake Hachinhama, on the opposite side of Clear Lake, exhausted themselves in yielding 140 tons in 1872.

The prospectors, however, had been aroused to interest in the mineral that was worth over $600 per ton and "only had to be shoveled up to be ready for the market," and discoveries in the deserts of California and Nevada followed each other with bewildering rapidity.

In 1873 San Bernardino county began her big record with the production of 515 tons from the so-called borax "marshes," or the "dry lakes" of the desert. Inyo county soon followed in lively rivalry, and the high water mark of the early years was reached in 1876, when 1,437 tons were produced, worth at that time over $312,000. From 1880 to 1888 the production increased slowly but steadily from 609 to 1,405 tons in a year. The year 1887 saw the suspension of work on the "marsh" beds, and the establishment of works on "colemanite" or borate of lime ores, in the Calico district, San Bernardino county. Since the discovery of these beds, large establishments have been erected in Alameda, near San Francisco, at Marion and Daggett, and at Bayonne, N. J., for the treatment of borates, and the production has risen from 1,405 tons in 1888 to 25,837 tons in 1900. The discoveries in Kern and Ventura counties also led to the establishment of boric acid manufacturing by the Stauffer Chemical Works of San Francisco, and the making of borax by the Chas. Pfizer & Co. works of New York.

When borax was first made in California, in 1864, the value of the refined article was 39 cents per pound, or $780 per ton. In spite of the discovery in Lake county, the price, while gradually declining, did not fall below 30 cents until 1873, when the borax "marshes" of San Bernardino county produced over 1,000,000 pounds, worth 24⅘ cents per pound, or $496 per ton.

The next year, 1874, saw the price fall to 14⅕ cents per pound, or $284 per ton, and the decline continued until 1879, when it stood at 9 cents per pound, or $180 per ton. From 1880 to 1883 the price varied from 12¼ to 14¾ cents per pound, or from $245 to $295 per ton. Prices in New York varied more widely than on the Western coast, as may be noted from one incident of many that might be quoted. In January, 1883, a tariff law was enacted that went into force in July of that year. During this six months, while imports were free from duty, 2,500 tons of boric acid, equivalent to 3,500 tons of borax, were imported. This, added to the large accumulations of the home manufacturers, caused the price to drop to 4½ cents per pound in New York, or less than the cost of production.

On the Coast, the result was that the producers combined and waited for living prices. From 1888 to 1894 the price stood still, practically, ranging from 6 to 7½ cents per pound, or from $120 to $150 per ton. Since that time the value of the refined article has been 5 or 6 cents per pound on the Coast, and about a cent higher in the East.

Owing to the establishment of the immense works in New Jersey, the shipments to the East are mainly in the form of crude borates, worth from $20 to $35 per ton, according to purity. The depression in prices, owing to rivalry between companies competing for the market, has been done away with, and the industry has outlived the disturbing features incident to youth, and has finally settled to a more certain and stable basis.

While the margin of profit is too small to permit the working of any but the most favorably located and economically handled deposits, yet the prevailing low prices are evidently causing an increased consumption of borates in the arts and manufactures in which they have been employed, and new uses are being continually found for the various compounds of boric acid. In this extended and ever growing consumption, the manufacturers find their compensation for low prices.

He further describes the process of preparing commercial borax as follows:

Every year has seen some improvement made in the industry in the way of more perfect appliances and processes. The process at first used in Lake county consisted in boiling the borax and crystallizing it in small pans holding from 2 to 3 gallons each; and the plant that produced the first 12 tons in 1864 consisted of some 4,000 such pans. The processes at the period when the "marsh" beds were worked consisted of boiling the crude material in large iron tanks and then running the solution into wood or iron settling tanks, the crude borax obtained being purified by recrystallization.

In the Calico district the colemanite ore is treated as follows at Marion: Low-grade ores, that were formerly rejected, are roasted in a Holthoff-Withey furnace, with two hearths having a capacity of 100 tons a day, six oil burners furnishing the heat. Colemanite when mildly heated is reduced to a fine powder, which is bolted, sacked, and shipped to the company's works at Bayonne, N. J.,

[1] Census of Manufactures, 1905, Bulletin 57, page 43.
[2] Twelfth Census, Manufactures, Part III, page 1030.
[3] Census of Manufactures, 1905, Bulletin 57, page 38.
[4] The Chemistry of Paper Making, page 162.
[5] Saline Deposits of California, page 36.

where the "flour" is boiled with soda to form borax. Any pandermite ore present is not affected by the heat and is lost in the waste, known locally as "dry bone." This waste often amounts to 50 per cent of the "flour" secured.

At Bayonne the huge machinery is driven by sets of independent electric motors. The crude colemanite reaches the works in sacks, as shipped from this state. It is first coarse-crushed on the ground floor of the works, and then conveyed to a Griffin mill, which reduces it to the fineness of flour. It is then carried by a screw conveyor to the foot of an elevator, which raises it to the first floor. Here it is dropped into a 100-ton tank and boiled with water. After boiling, it is drawn into settling tanks on the second floor, where the clear solution is run back to crystallizing vats on the first floor, the sediment being raised by a centrifugal pump to a tank on the third floor, and thence into a filter press of 50 pounds per square inch, the pulp receiving finally, however, double that pressure. The liquor drawn from the press goes back to the settling tank, and the refuse cakes go to the dump.

The crystallizing vats are of sheet iron 20 feet long by 6 feet wide and 6½ feet deep. Two-inch iron pipes are laid across the top of the vats, from which wires 5 feet long and 0.25 inch in diameter hang into the vats. As the solution cools, the borax crystallizes upon the wires and on the sides and bottoms of the vats. After crystallization, the mother liquor is pumped out and used again as a solvent, and the borax crystals removed. The crystallized borax is raised to the fourth floor to crushing rolls and screens and sorted into three sizes, viz: (1) Refined crystals; (2) refined screenings; (3) granulated borax. The granulated borax is then dried by hot air, in an inclined rotary cylinder; then pulverized in a cyclone pulverizer; then caught in dust chambers; and finally barreled for the market.

It is found that while the borax from the wires in the vat is pure, that from the sides and bottom has to be redissolved and refined.

The statistics of imports are from "Commerce and Navigation of the United States," published by the Bureau of Statistics, Department of Commerce and Labor.

TABLE 39.—SODAS—IMPORTS ENTERED FOR CONSUMPTION: 1891 TO 1905.

YEAR ENDING JUNE 30—	SODA ASH.		SAL SODA.		CAUSTIC SODA.		ALL OTHER SALTS OF SODA.		BORAX.		BORATES OF LIME OR SODA, OR OTHER BORATE MATERIAL.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1891	[1] 354,744,335	$4,382,917	(2)	(2)	78,743,976	$1,874,700	18,136,888	$118,713	10,725	$1,062	414,151	$17,681
1892	[1] 339,057,006	4,496,597	(2)	(2)	64,741,106	1,598,903	22,348,570	167,634	3,970	426	40	6
1893	388,910,183	4,855,098	27,531,554	$238,029	57,485,106	1,344,525	47,664,938	297,761	11,230	1,327	543,967	13,659
1894	256,293,395	2,520,921	16,893,760	120,794	38,987,832	850,753	14,829,622	104,800	1,812	225	441,066	11,427
1895	300,599,257	2,367,109	28,761,108	167,325	57,653,959	1,044,809	11,803,171	141,070	612,730	26,429	4,234,361	105,604
1896	251,067,856	1,950,981	17,966,996	84,423	61,713,044	1,071,169	9,090,367	149,248	11,376	796	4,307,100	104,952
1897	162,585,074	1,241,321	18,875,029	82,695	66,476,152	1,147,763	3,919,339	67,684	2,209	249	6,946,205	171,101
1898	87,809,619	589,714	8,851,011	40,266	29,697,185	476,032	21,400,585	225,628	42,407	2,541	1,381,175	31,726
1899	45,444,305	310,742	4,224,680	20,905	18,405,272	252,297	23,891,135	317,032	35,228	2,755	1,161,808	24,903
1900	78,571,870	648,450	6,624,314	31,072	11,429,989	177,857	23,632,374	314,425	136,610	5,960	36,266	3,594
1901	34,451,228	307,298	5,191,350	28,229	5,119,099	106,248	16,757,354	178,205	501,136	18,291	84,200	7,491
1902	27,636,757	262,106	3,560,460	21,084	4,297,850	100,557	15,422,281	276,239	849,088	26,865	121,686	10,746
1903	24,688,625	232,201	4,083,961	23,298	2,657,751	66,176	17,705,615	281,505	72,479	4,441	206,839	13,841
1904	19,563,349	188,750	3,705,930	20,855	2,945,709	74,072	10,550,404	278,333	72,888	5,464	122,848	11,021
1905	17,930,376	166,279	2,901,544	18,344	2,190,820	54,474	10,044,341	230,570	192,950	13,002	27,056	1,157

[1] Includes sal soda. [2] Not reported separately.

BIBLIOGRAPHY.

BAILEY, GILBERT E. *The Saline Deposits of California*, Bulletin No. 24, California State Mining Bureau, 1902.

GRIFFIN, R. B. and LITTLE, A. D. *The Chemistry of Paper-Making*, New York, 1894.

HART, P. *A few Facts in the History of Solid Caustic*, Journal of Society of Chemical Industry, vol. 5, 1886, page 283.

KOCKERSCHEIDT, J. WILK. *Über die Preisbewegung Chemischer Produkte*, Jena, Gustav Fischer, 1905.

LAMBORN, LEEBERT LLOYD. *Modern Soaps, Candles, and Glycerin*, New York, 1906.

LUCION, R. *Contribution to the History of the Ammonia Soda Process*, Journal of Society of Chemical Industry, vol. 8, 1889, page 460.

LUNGE, GEORGE. *Sulphuric Acid and Alkali*, London, 1895, Vol. II; 1896, Vol. III.

MARTYN, WILLIAM. *Production of Soda Crystals in the United States*, Journal of Society of Chemical Industry, vol. 4, 1885, page 28.

PENNOCK, JOHN D. *Progress of the Soda Industry in the United States since 1900*, Bericht V. Internationaler Kongress für angewandte Chemie, 1904, vol. 1, page 661.

—— *Recent Progress in Industrial Chemistry*, Journal of American Chemical Society, 1906, vol. 28, page 1242.

SOLVAY, ERNEST. *Coup d'œil rétrospectif sur la procédé de fabrication de la soude à l'ammoniaque*, Bericht V. Internationaler Kongress für angewandte Chemie, 1904, vol. 1, page 108.

Tariff hearings before the Committee on Ways and Means, Fifty-first Congress, 1st session, 1889–90. Misc. Doc. No. 176. *Soda Ash*, page 341. *Borax and its Products*, page 361. Washington, 1890.

Tariff hearings before the Committee on Ways and Means, Fifty-third Congress, 1st session, 1889–90. Misc. Doc. No. 43. *Alum and Soda*, page 15. *Borax*, page 18. Washington, 1893.

THE SOLVAY PROCESS COMPANY. *The Solvay Process Alkali; Its Various Forms and Uses*. Syracuse, N. Y., 1896.

THORP, FRANK HULL. *Outlines of Industrial Chemistry*, second edition, New York, 1905.

CLASS III.—POTASHES.

The class of potashes comprises stone-ash (known also as crude potash and lump potash), which is a mixture of caustic potash, potassium carbonate, and potassium sulphate with organic and various kinds of inorganic matter; potash, or black salts, or black flux, which is the unrefined potassium carbonate produced by calcining stone-ash or argols, or wine lees; and pearlash, or white flux, which is refined potassium carbonate. The term "potash" has also long been used to designate caustic potash, known also as vegetable alkali, potassium hydrate, or hydroxide, but as here used the term is more comprehensive. Caustic potash is properly included here with the potassium carbonate, as caustic soda was with the sodium carbonates under "sodas." Were any potassium hydrogen carbonate or

bicarbonate of potash to be reported, the data for it would be entered under this class.

A detailed description of the American process for the production of potashes from the ashes of plants, together with a resumé of the processes in use abroad, and of those proposed for use in the production of potashes from various sources, was given in the special report on chemicals and allied products for the census of 1900. It is evident from the nature of the operations and the character of the materials used in the American process that, in a majority of instances, the industry is a neighborhood industry, and hence one which does not come within the scope of the census of 1905. Statistics for production, however, were taken within the states, and it therefore becomes possible to present their results in comparison with those presented separately at each census beginning with that of 1850. The quantity and value of the potashes reported at each census from 1850 to 1905 are set forth in Table 40.

TABLE **40.**—*Potashes—quantity and value of products: 1850 to 1905.*

CENSUS.	Number of establishments.	PRODUCT.		Average price per pound.
		Pounds.	Value.	
1905	[1] 39	1,811,037	$104,655	$0.058
1900	[1] 67	3,864,766	178,180	0.046
1890	75	5,106,939	197,507	0.039
1880	68	4,571,671	232,643	0.051
1870	105	....	327,671	....
1860	212	....	538,550	....
1850	569	....	1,401,533	....

[1] Includes establishments engaged primarily in the manufacture of other products.

The statistics in Table 40 show a constant decrease in the total value of the product since 1850 and a steady decrease in the quantity of the product since 1890. This seems quite reasonable, in consideration of the destruction of the forests during recent years, and the resulting decrease in the quantity of ashes readily available for the manufacture of potashes; also in consideration of the decrease in the native fertility of the soil, with which has come an inclination to return potash to the soil as it occurs in the ashes rather than to extract and market it; and also in consideration of the cheapening of soda or hard soaps and increased facilities for bringing them to agricultural communities, whereby the temptation to extract potash from ashes for the manufacture of potash or soft soaps is lessened. These causes, combined with the comparative cheapness of foreign potashes, tend to destroy the domestic industry. The data of Table 40 indicate that the industry is a waning one, and that it may come to be of so slight importance as not to warrant separate consideration in subsequent censuses, unless other causes, recently set in operation, shall revive it in another form.

Although potassium occurs in considerable quantities in India saltpeter, in orthoclase feldspar, and in many other minerals which have long been used for many purposes in the arts, yet up to about the middle of the nineteenth century the ashes of plants were practically the sole source of supply of potashes. In the beginning of that century Stassfurt, in Germany, was noted for its salt works, in which salt was produced by the evaporation of natural brine obtained, by pumping, from driven salt wells. With the utilization of rock salt deposits in various localities the price of salt was reduced to such a point that the Stassfurt works ceased to yield their former large revenue to the Prussian Government, and with a view of making them again valuable the Government began boring for rock salt in this locality in 1839. In 1857 a shaft, which was begun in 1852, reached at a depth of 1,080 feet a stratum of rock salt, but in doing so it passed through a heavy deposit of so-called "abraumsalze," or refuse salts, which consisted largely of compounds of potassium and magnesium, which were then considered worthless.[1] This deposit is now, and has long been, the chief source of the potashes and the potassium salts of commerce. These native Stassfurt potash salts consist of the minerals carnallite, which is a magnesium potassium chloride; sylvite, which is potassium chloride; and kainite, which is a magnesium potassium chloride containing also magnesium chloride.

As early as 1861 patents were granted to A. Frank for the extraction of potassium chloride from the abraum salts, and since then a variety of processes of extraction have been invented and put into use. By treating this potassium chloride with sulphuric acid, limestone, and coal, as Le Blanc treated sodium chloride, potassium carbonate is obtained. By means of a process analogous to the ammonia-soda process, potassium chloride being used in place of sodium chloride and trimethylammonium carbonate in place of ammonium carbonate, potassium hydrogen carbonate, or bicarbonate of potash is obtained. By causticizing these carbonates with lime, caustic potash is obtained.

The Stassfurt deposit of potassium salts has been explored since its discovery and it has been found to cover an area of about 100 square miles. The stratum of carnallite, which is the most abundant and commercially most important, is from 50 to 150 feet in thickness. This deposit continues to be the chief source of the world's supply of potassium salts, except the nitrate, and the mining of them and their conversion into potashes and other commercial salts gives employment to a large force of men. It is stated that these German mines, and the chemical works connected with them, employ 10,000 miners, 15,000 laborers, and 800 chemists and technical experts, besides a large clerical force.[2]

Consideration is now being given to deposits of potassium salts within the territory of our own country, and this subject is discussed at length by William M. Courtis, who says:[3]

[1] Potash in Agriculture, The German Kali Works, page 5.
[2] Mineral Industry, 1907, Vol. XV, page 659.
[3] Ibid., page 663.

There are several large and well-known supplies of surface potash in this country, which could be utilized in the event of the imports of the United States being entirely cut off, but at present they are remote from railroads, in the desert portion of this country, and the cost of working would be prohibitive. These deposits are largely mixed with soda salts and would require washing, and this would be costly. The salts consist of sulphates and nitrates only, the chloride not having been found in any quantity. It is probable that with so many surface indications, occurring where conditions are similar to those of the Stassfurt district, boring on a large scale would supply information which would eventually lead to the discovery of a bed similar to that of Germany, but it would require a large expenditure for blind boring. However, in Germany the surface indications were so slight that the immense deposits were not discovered until a comparatively few years ago, and then only by accident.

Since the census of 1900 a new method for the manufacture of caustic potash from potassium chloride has been put in operation in this country. This is described as follows:[1]

The Roberts Chemical Company, of Niagara Falls, electrolyze potassium chloride. At the cathode caustic potash is produced and hydrogen is set free, while at the anode chlorine is set free. The quantities of hydrogen and chlorine are in equivalent proportions, so that they may be combined to form hydrochloric acid. This is done by the Roberts Chemical Company, the two products of which are, therefore, hydrochloric acid and caustic potash. In the September issue of Things Chemical, of the Charles E. Sholes Company, who are the sales agents of the Roberts Chemical Company, it is pointed out that on account of its method of production, this hydrochloric acid can not contain the ordinary impurities of muriatic acid unless they were expressly and intentionally added. Its only impurity is a small amount of free chlorine, which gives it a pale yellow color. The acid is of special interest to manufacturers of fine chemical products, gas mantles, cereals and foodstuffs (where there must be no arsenic), high grade and fancy leathers, and in general, for all purposes where quality is of more importance than a slightly increased first cost. The electrolytic caustic potash is made in three forms: Fused (solid), in drums of 100, 200, and 800 pounds; broken, in drums of 100, 250, 500, and 1,000 pounds; and caustic potash solution, in drums of 325, 650, and 1,350 pounds. The solid and broken grades analyze not less than 85 to 87 per cent KOH and 10 to 15 per cent carbonate and chloride of potassium. The solution contains 45 to 47 per cent KOH. Caustic potash is now very largely used in electroplating shops for removing grease from metallic surfaces before plating. In the laundry a dilute solution of caustic potash is an excellent "builder," for the soap will remove all grease and produces excellent suds, without injury to the fabric. Soapmakers use caustic potash especially for all the finest soaps, whereas caustic soda is used for the common grades.

Another direction in which the potash industry tends to develop is in the production of potashes from the potash or orthoclase feldspar and from other minerals containing potassium. Several inventions for the extraction of potash from these minerals have been patented, the latest patent, No. 851922, of April 30, 1907, having been granted Dr. Allerton S. Cushman, assistant director of the United States road material laboratory, for a process for the extraction of potash, soda, and other soluble bases from ground rocks. This is described as follows:[2]

Feldspathic or other potash bearing rock is ground to fine powder, slimed with water, and placed inside of a suitable wooden container, which is then set inside of another larger vessel. Water is now placed in the outer vessel and electrodes inserted, so that the inner or slime chamber becomes connected with the positive pole, and the outer chamber with the negative pole. A current of electricity from a dynamo is then turned on. When this is done the potash, soda, and other soluble bases are partially set free from the combinations with alumina and silica in which they exist in the feldspathic rocks.

Under the influence of electrolysis the soluble bases pass through the wooden partition and the water in the outer vessel becomes alkaline, owing to the accumulation of potassium and sodium hydroxide. The electrical resistance of the cells arranged in this way is so high that only a small fraction of an ampere passes through under a potential of 110 volts. After a certain percentage of the alkali has been extracted in this manner, the action slows down, and it has been found necessary to devise methods to accelerate the action.

Doctor Cushman has discovered two methods for accelerating the decomposition of the rock slime and hastening the extraction of the potash: (*a*) By a suitable grinding or churning arrangement the slime in the inner chamber can be kept in a continual agitation, which causes the necessary reactions to go on more rapidly. (*b*) If a small quantity of hydrofluoric acid is added to the slime a very great acceleration in the rate of decomposition and extraction is obtained, and it is possible in a reasonably short time to make a complete extraction of all the potash contained.

If instead of caustic potash it is desired to make various salts of potash such as are in ordinary use for fertilizers and other purposes, that is, nitrate, sulphate, chloride, and phosphate, the corresponding acids—nitric, sulphuric, hydrochloric, and phosphoric—are fed in a dilute form into the outer or so-called cathode chamber, fast enough to neutralize the caustic alkali as it forms. By varying the amount of acid added, the resistance of the cell can be controlled and the decomposition of the rock carried on under the best and most economic conditions.

The consumption of potash or pearlash in the glass industry of the United States was, at the census of 1890,[3] 2,544,978 pounds, valued at $135,047, and at the census of 1900,[3] 4,406,211 pounds, valued at $186,847. The quantity of potash used in the soap industry at the census of 1905[4] was 4,453,800 pounds, valued at $191,933, but this does not include the quantity of potash produced and consumed in the same establishments in the manufacture of soft soap. These are two of the industries in which the largest quantities of potashes are used.

Table 41 shows the imports and exports of potashes and ashes as taken from Commerce and Navigation of the United States, published by the Bureau of Statistics.

[1] Electrochemical and Metallurgical Industry, 1906, Vol. IV, page 382.

[2] The Chemical Engineer, 1907, Vol. V, page 21.

[3] Twelfth Census, Manufactures, Part III, page 983.

[4] Census of Manufactures, 1905, Bulletin 57, page 43.

TABLE 41.—IMPORTS OF POTASHES, ASHES (WOOD) AND LYE OF, AND BEET ROOT ASHES, ENTERED FOR CONSUMPTION; AND DOMESTIC EXPORTS OF POTASHES AND PEARLASHES: 1891 TO 1905.

YEAR ENDING JUNE 30—	IMPORTS OF BICARBONATE OF POTASH.		IMPORTS OF CARBONATE OF POTASH.				IMPORTS OF CAUSTIC OR HYDRATE OF POTASH.				Imports of ashes (wood) and lye of, and beet root ashes (value).	DOMESTIC EXPORTS OF POTASHES AND PEARLASHES.	
			Crude or black salts.		Refined.		Not including refined, in sticks or rolls.		Refined, in sticks or rolls.				
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.		Pounds.	Value.
1891....	76,828	$4,344	[1] 6,207,419	$219,557	....	....	1,882,461	$84,429	9,145	$1,106	$42,624	430,582	$24,432
1892....	40,759	2,290	8,745,268	309,585	....	....	1,810,604	79,649	56,075	3,035	54,855	1,307,634	99,566
1893....	74,983	3,903	10,115,017	329,895	....	....	2,338,868	99,177	9,513	1,781	76,306	634,421	31,775
1894....	2,716	168	[1] 8,130,975	262,818	....	....	[2] 1,471,511	62,671	36,510	1,877	74,050	650,261	29,205
1895....	117,674	7,401	11,602,272	364,506	....	....	[2] 3,015,361	123,798	1,305	194	77,708	664,876	30,188
1896....	71,350	3,457	12,439,180	401,819	....	....	[2] 3,322,261	135,826	....	....	67,393	969,874	41,208
1897....	303,447	15,053	7,501,497	229,029	420,513	$24,727	[2] 4,011,996	165,735	....	....	66,423	511,830	21,727
1898....	115,711	5,936	15,844,374	471,919	22,941	727	[2] 3,354,245	125,591	15,577	2,119	62,206	869,841	33,202
1899....	132,431	7,239	16,018,889	437,675	637,587	16,783	3,454,739	132,331	36,055	3,643	59,970	745,433	29,676
1900....	162,798	9,666	21,191,258	625,922	2,968,051	87,987	3,612,595	157,842	23,297	2,715	66,453	1,273,905	49,566
1901....	73,770	5,054	18,888,612	627,601	3,448,249	112,783	3,840,777	180,277	86,798	7,195	76,306	1,043,817	56,072
1902....	56,970	3,625	18,671,566	624,042	3,869,549	125,445	4,118,079	191,281	33,518	4,526	88,096	1,363,355	62,529
1903....	19,130	1,518	11,130,789	141,033	17,689,935	507,219	4,499,555	193,350	31,632	3,853	76,156	1,193,258	60,376
1904....	93,769	4,778	8,193,872	224,396	13,586,306	397,104	4,810,993	194,839	36,048	4,879	62,641	1,027,181	56,800
1905....	76,983	4,504	7,166,569	218,816	13,687,083	440,139	5,269,804	217,041	22,313	2,537	60,713	542,832	30,156

[1] Fused.

[2] Includes some refined admitted free.

CLASS IV.—ALUMS.

The class of alums comprises potash, ammonia and soda alums, and all other double sulphates of aluminum with the alkali metals, or their isomorphs, such as chrome alum; burnt alum, known also as dried alum and alumen exsiccatum, or ustum; porous alum, which is effloresced soda alum, or else the product obtained by mixing soda ash with alum cake; aluminum sulphate; concentrated alum, which is crystallized aluminum sulphate; alum cake, which is crude aluminum sulphate; alumino-ferric cake, which is alum cake containing a considerable amount of iron; and aluminum hydrate, or hydroxide.

Statistics for the alum industry have been reported separately at each census beginning with that of 1880. At the census of 1900 the quantity and value of each of the chief varieties of alums were also set forth.

TABLE 42.—*Alums—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	8	4	4	100.0
Capital	$11,836,933	$5,553,313	$6,283,620	113.2
Salaried officials, clerks, etc., number	87	27	60	222.2
Salaries	$135,226	$64,328	$70,898	110.2
Wage-earners, average number	2,559	1,496	1,063	71.1
Total wages	$1,331,776	$773,356	$558,420	72.2
Miscellaneous expenses	$467,113	$214,997	$252,116	117.3
Cost of materials used	$2,583,173	$1,318,906	$1,264,267	95.9
Value of products[1]	$5,058,395	$2,882,421	$2,175,974	75.5

[1] Includes "all other products."

Table 42 presents the statistics for the principal establishments only. An increase is shown in every item, the largest per cent of increase being in the number of salaried officials, clerks, etc., and the next largest being in miscellaneous expenses.

TABLE 43.—ALUMS—QUANTITY AND VALUE: 1880 TO 1905.

CENSUS.	Establishments.	Quantity (pounds).	Value.	INCREASE.			PER CENT OF INCREASE.		
				Establishments.	Quantity (pounds).	Value.	Establishments.	Quantity (pounds).	Value.
1905	17	225,543,308	$2,956,844	4	40,898,011	$440,424	30.8	22.1	17.5
1900	13	[1] 184,645,297	[1] 2,516,420	3	90,647,289	899,710	30.0	96.4	55.7
1890	10	93,998,008	1,616,710	4	54,780,283	808,545	66.7	139.7	100.0
1880	6	39,217,725	808,165	....	....	....	....	....	....

[1] Includes 5,177,826 pounds, with an assigned value of $69,844, consumed in establishments where manufactured; and also the alum reported by establishments engaged primarily in the manufacture of other products.

The data of Table 43 shows, when the industry is considered as a whole as well as when only the operation of the principal establishments is considered, that there has been an increase in every item at each succeeding census, and that the industry was in a flourishing condition at the census of 1905. A comparison of the increases at the various periods shows that while the greatest percentage of increase in every item occurred in the interval from 1880 to 1890, the largest actual increase in both quantity and value occurred in the interval from 1890 to 1900. It is to be observed that the data for 1900 includes the quantity and value of alum which was produced and consumed. No information on this point is available for 1905.

TABLE 44.—*Kinds of alum—quantity and value of products: 1905 and 1900.*

KIND.	1905		1900	
	Pounds.	Value.	Pounds.	Value.
Total	225,543,308	$2,956,844	179,467,471	$2,446,576
Ammonia alum	3,467,104	59,774	6,580,373	102,308
Burnt alum	15,858,335	364,328	6,628,914	174,600
Concentrated alum	80,919,272	972,892	103,016,815	1,062,547
Potash alum	10,307,154	156,448	14,200,393	215,004
Soda alum	82,050	4,923	9,399,550	228,500
Alum cake	19,496,047	161,906	4,048,655	34,047
Other alums	95,413,346	1,236,573	35,592,771	629,570

The data of Table 44 shows that a larger proportion of the alums returned at the census of 1905 is included under the heading "other alums" than at the census of 1900, and that there has been a decrease in every other item, except in the quantity and value of burnt alum and of alum cake, items which show marked increases. The greatest decrease is in the quantity and value of soda alum, but, as pointed out in the special report for 1900, this is often included under burnt alum; there is reason for this, since as sold it does not usually contain the water of crystallization, which is characteristic of the crystallized alums. Some manufacturers contend that soda alum, which is known in trade as "C. T. S.," or "cream of tartar substitute," is not an alum, and accordingly they may have reported it under "all other products." This would reduce the total quantity and value of alums and may be an additional means of explaining why the increases shown for the industry at the census of 1905 are not proportionate to those shown at the census of 1900.

TABLE 45.—*Alums—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1]17	[1]13
California	1	
Illinois	3	1
Massachusetts	3	3
Michigan	1	1
New York	2	2
Ohio	1	
Pennsylvania	6	6

[1] Includes 9 establishments engaged primarily in the manufacture of other products.

Table 45 shows the same number of establishments in operation at the censuses of 1905 and 1900 in every state except Illinois, where there has been a gain of 2 establishments, and California and Ohio, in each of which 1 plant has been established. Pennsylvania stands first at each census. Massachusetts stands second at each, being joined in this place at the census of 1905 by Illinois. No other state had more than 2 establishments at either census.

TABLE 46.—*Alums—value of products, by states: 1905 and 1900.*

STATE.	1905	1900
United States	$2,956,844	$2,446,576
Pennsylvania	1,479,340	1,411,652
Massachusetts	270,614	306,754
Illinois	481,754	(1)
All other states [2]	725,136	728,170

[1] Included in "all other states."
[2] Includes in 1905 California, Michigan, New York, and Ohio; in 1900, Illinois, New York, and Michigan.

Table 46 shows that at each census Pennsylvania stood first in the value of alums produced and "all other states" second. It also shows for the later census a decrease in the value of the product for Massachusetts, and an apparent decrease for "all other states," but as the value of the product from Illinois was reported separately at the census of 1905, while it was included in the item "all other states" for 1900, the only real decrease is in the returns for Massachusetts.

In the census year 1900 there were used in the manufacture of alums, including those produced and consumed, 39,000 tons of bauxite, valued at $263,850; 5,000 tons of cryolite, valued at $110,000; 2,000 tons of sodium sulphate, in the form of salt cake or niter cake, valued at $4,100; 755 tons of soda ash, valued at $8,744; 360 tons of ammonium sulphate, valued at $21,900; 477 tons of potassium sulphate, valued at $19,600; and 71,426 tons[1] of sulphuric acid, in the manufacture of which were used 3,323 tons of sulphur (valued at $66,000), 28,358 tons of pyrites (valued at $133,282), and 720 tons of sodium nitrate (valued at $25,200). In 1905 there were used in this industry 53,246 tons of bauxite, valued at $423,643; 4,867 tons of aluminum hydrate, or hydroxide, valued at $223,882; 4,141 tons of sodium sulphate, valued at $11,627; 8,657 tons of soda ash, valued at $162,394; 179 tons of ammonium sulphate, valued at $11,165; 1,288 tons of potassium sulphate, valued at $55,951; and 80,672 tons of sulphuric acid of 50° Baumé, in the manufacture of which were used 38,233 tons of pyrites (valued at $187,341) and 807 tons of sodium nitrate (valued at $32,280).

Table 47 shows the imports of alums and materials for alum making as taken from Commerce and Navigation of the United States, published by the Bureau of Statistics.

[1] Recalculated from ascertained yields in practice.

TABLE 47.—ALUMS, CRYOLITE, AND BAUXITE—IMPORTS FOR CONSUMPTION: 1891 TO 1905.

YEAR ENDING JUNE 30—	ALUMS.		CRYOLITE.		BAUXITE.			
					Bauxite, crude.		Aluminum hydrate or refined bauxite.	
	Pounds.	Value.	Tons.	Value.	Pounds.	Value.	Pounds.	Value.
1891	4,652,985	$58,863	7,129	$95,405				
1892	4,140,916	59,336	8,298	76,350				
1893	4,572,923	73,806	8,459	111,796				
1894	1,838,728	30,831	12,756	170,215				
1895	2,983,682	46,815	8,685	116,273				
1896	5,525,825	86,371	7,024	93,198				
1897	5,301,544	96,529	3,009	40,056	8,722,074	$14,915		
1898	2,787,639	36,099	10,788	144,178			2,092,082	$60,194
1899	1,601,829	14,244	5,529	79,455	7,722,000	14,168	2,955,339	92,019
1900	2,186,266	19,354	5,878	78,658	6,850,000	11,413	3,474,421	109,574
1901	2,120,119	21,179	6,167	82,533	33,526,000	63,597	5,584,477	199,950
1902	1,970,961	18,217	4,653	61,116	29,418,000	52,245	1,448,505	53,557
1903	1,865,006	17,321	7,565	104,178	33,534,240	56,861	1,520,273	50,132
1904	1,465,709	13,501	6,332	84,359	38,609,160	62,452	1,656,635	55,826
1905	2,395,071	23,600	998	17,707	19,100,000	32,813	16,291	1,388

CLASS V.—COAL TAR PRODUCTS.

The class of coal tar products comprises the materials obtained by the distillation of coal tar, known as coal tar distillery products, which include pitch, creosote oil, dead oil and other tar oils, benzol (benzene), toluol, xylol, naphthalene, anthracene and other coal tar hydrocarbons, phenol (carbolic acid), cresol, naphthol, resorcin, or resorcinol, and other coal tar tertiary alcohols, and aniline, toluidine, xylidine, and other coal tar amines; and chemicals made from coal tar distillery products, which include the aldehydes, acids, ketones, salts, and various other so-called benzene derivates. These cover the so-called coal tar dyes, which appear also under "dyestuffs," and many nitro-substitution compounds and synthetic preparations, which appear again under "essential oils" or "fine chemicals." There is a further duplication in that many establishments in which coal tar is distilled consume part of the product in the further manufacture of roofing felt, roofing paper, and roofing preparations which belong either in the class of "roofing and roofing materials" or of "paints." These duplications are necessary in order to show the condition of the industry as a whole. In view of these facts it is evident that the classifying of the coal tar products presents very serious difficulties and that for this industry there will necessarily be at the different censuses variations in the statistics.

TABLE 48.—*Coal tar products—comparative summary, with amount and per cent of decrease: 1905 and 1900.*

	CENSUS.		Decrease.	Per cent of decrease.
	1905	1900		
Number of establishments	6	15	9	60.0
Capital	$837,991	$2,095,363	$1,257,372	60.0
Salaried officials, clerks, etc., number	41	84	43	51.2
Salaries	$65,802	$152,817	$87,015	57.0
Wage-earners, average number	129	514	385	74.9
Total wages	$70,972	$257,838	$186,866	72.5
Miscellaneous expenses	$114,389	$190,041	$75,652	39.8
Cost of materials used	$538,617	$1,341,561	$802,944	59.9
Value of products	$820,309	$2,227,544	$1,407,235	63.2

Table 48 shows a decrease in every item for 1905 as compared with 1900, the greatest percentage of decrease being in the average number of wage-earners and in wages paid, and the least in miscellaneous expenses. The cause of the decreases is due chiefly, if not entirely, to the fact that establishments which in 1900 produced coal tar distillery products as their principal product and roofing materials as a subsidiary product, in 1905 produced roofing materials as their principal product, and were thus taken out of the class of coal tar products establishments. It is pointed out, in the special report on this industry for the census of 1900, that tarred felt and tarred paper, in which part of the material produced from the coal tar was consumed in further manufacture, were produced to the value of $442,529.

Statistics for this industry were first reported separately at the census of 1880, since which time they have been reported separately at each census. As no data are at command by which to ascertain the quantity of the coal tar products which were produced and consumed, these statistics show only the totals of those products produced for sale.

TABLE 49.—*Coal tar products—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1] 39	[2] 22
California	1	1
Illinois	1	
Louisiana		1
Maine	3	
Massachusetts	3	2
Michigan	1	
Minnesota		1
Missouri	3	3
New Jersey	8	2
New York	8	3
Ohio	3	2
Pennsylvania	6	6
Rhode Island	1	
Tennessee	1	1

[1] Includes 33 establishments engaged primarily in the manufacture of other products.
[2] Includes 7 establishments engaged primarily in the manufacture of other products.

Table 49 shows that there has been an increase of 17 in number, or 77.3 per cent, for the establishments

in the United States for 1905 as compared with 1900, the increases for the individual states reporting in 1900 being 6 in New Jersey, 5 in New York, and 1 in Ohio, while Maine reports 3 establishments and Illinois, Michigan, and Rhode Island 1 each for the first time at the census of 1905. Louisiana and Minnesota which reported 1 establishment each in 1900 did not report any in 1905. At the census of 1900 Pennsylvania stood first in the number of establishments, with Missouri and New York sharing second place. No other state returned more than 2 establishments. At the census of 1905 New Jersey and New York shared first place, Pennsylvania occupied second, and Maine, Massachusetts, Missouri, and Ohio shared third. No other state returned more than 1 establishment.

TABLE 50.—*Coal tar products*[1]*—value, by states: 1890 to 1905.*

STATE.	1905		1900		1890
	Number of establishments.	Value of products.	Number of establishments.	Value of products.	Value of products.
United States	39	$3,984,821	22	$1,421,720	$687,591
District of Columbia					20,000
Georgia					20,000
Maine	3	30,051			
Massachusetts	3	175,978			
Missouri	3	284,637	3	415,600	
New Jersey	8	1,664,136	(2)	(2)	330,200
New York	8	926,329	3	44,016	138,324
Ohio	3	463,001	(2)	(2)	
Pennsylvania	6	375,757	6	396,759	168,180
All other states	[3] 5	64,932	10	565,345	10,887

[1] Showing value of coal tar products only.
[2] Included in "all other states."
[3] Includes in 1905 California, Illinois, Michigan, Rhode Island, and Tennessee; in 1900, California, Louisiana, Massachusetts, Minnesota, New Jersey, Ohio, and Tennessee; in 1890, Massachusetts and Tennessee.

The rank of the states at the different censuses, as determined by the value of products, has varied in an erratic manner. New Jersey, which ranked first in 1890 and again in 1905, was classified under "all other states" in 1900; Missouri, which ranked first in 1900, took the fifth place in 1905; and Pennsylvania, which ranked second in 1900, passed to the fourth place in 1905; New York, which ranked third in 1890 and in 1900, rose to the second place in 1905; Ohio, which had not been reported separately at any previous census, took the third place in 1905. At each census the largest portion of the product has been reported from the Middle Atlantic states.

Coal tar is produced in the destructive distillation of bituminous coal, and is therefore a by-product of the coal gas industry and, when by-product ovens are used, of the coke industry. The unit of measure used in treatises on this material is sometimes gallons and sometimes tons. But since a gallon of coal tar weighs, on an average, 10 pounds, it is a simple matter to convert the quantities given in one of these units into terms of the other. At the census of 1900[1] it was estimated that the quantity of coal tar produced in the gas industry in this country was 67,094 tons, and the quantity of water gas tar produced, 222,868 tons. At the census of 1905[2] the quantity of tar reported was 67,515,421 gallons, or 337,577 tons. This includes both the coal tar from the straight coal gas process, and the water gas tar produced chiefly in carbureting the water gas. As the two processes are often carried on in conjunction, it is not a simple matter for the producers to give separate returns for them, and hence a combined return was received. Assuming, however, that the ratio of each approximated that reported for the census of 1900, which was closely 23 of coal gas tar to 77 of water gas tar, the amount reported for the census of 1905, in the gas industry, was equivalent to 77,643 tons of coal tar and 259,934 tons of water gas tar. In the coke industry, at the same census, the quantity of coal tar reported was 26,223,323 gallons, or 131,117 tons.[3] There was therefore available in the United States in 1905, 208,760 tons of coal tar as compared with 119,438 tons in 1900, and 468,694 tons of coal and water gas tar as compared with 342,306 tons in 1900. It is to be noted that at the later census the coal tar production from coke ovens exceeded that from coal gas plants. The amount of coal tar reported as used in the United States at the census of 1900 was 110,023 tons, and at the census of 1905, 127,756 tons; at the later census there were also reported as used 117,459 tons of oil gas tar.

Among the products of this industry reported at the census of 1905 were 61,100 tons of pitch, valued at $800,862; 577,750 gallons of refined coal tar, valued at $22,704; 18,750 gallons of ready mixed paints, valued at $5,621, these three products evidently having been made from coal tar pitch and light distillate; 288,817 gallons of creosote oil, valued at $17,546; 17,175 tons of oils, including light, heavy, and dead oils, and probably some creosote oil, valued at $308,830; coal tar distillery products, probably comprising some of the foregoing, valued at $7,613; 5,872,360 pounds of coal tar dyes, valued at $2,348,189; and 2,391,866 pounds of chemicals made from coal tar distillery products, including salicylic acid and its derivatives, saccharine, and phenol preparations and derivatives, valued at $569,024. It is believed that many of these are lost in the classifications "druggists' preparations" and "patent medicines and compounds." At the census of 1900 the chemicals made from coal tar distillery products were valued at $205,047. Pyridine and its homologues, some of these chemicals, are used for denaturing alcohol, and, as the Commissioner of Internal Revenue has ruled that alcohol denatured by their use may be used tax free in the arts and manufactures and for domestic purposes, it is reasonable to suppose that in subsequent census returns these substances may be enumerated as separate items.

[1] Twelfth Census, Manufactures, Part IV, page 549.

[2] Census of Manufactures, 1905, Bulletin 57, page 42.
[3] Census of Manufactures, 1905, Bulletin 65, page 17.

A comparison of the coal tar reported as used in the manufacture of coal tar products, with the coal tar produced in the coal gas and coke industries, shows that in 1900 there was used in the manufacture of coal tar products 92.1 per cent of the entire amount produced, and in 1905 but 61.2 per cent; at the latter census the amount of oil gas tar used nearly equaled that of the coal tar. These figures indicate that other and increasing uses for coal tar than that of converting it into coal tar products are being found, such for instance as employing it for fuel in internal combustion engines of the Diesel type. Despite these uses, however, our resources for tar are by no means exhausted; it is estimated that in 1905, 28 per cent of the tar produced in by-product coke works was consumed as fuel in the works, and it is shown in the bulletin on coke for 1905,[1] that had all the coal which was coked in that census year been coked in by-product ovens, at the average rate of yield which obtained for the coal actually so coked, there would have been produced 295,273,173 gallons, or 1,476,366 tons, of coal tar from that source alone. There is therefore no lack of coal tar for our industries. In fact, the difficulty of profitably disposing of that now produced is a large factor in delaying the erection of additional by-product coke plants. Nor is there yet any restriction on the amount of benzene and its homologues available for use in the aniline dye industry, for, besides that which occurs in the coal tar, a considerable amount, which might be utilized, is allowed to pass off in the gas from by-product ovens. Of the 10,000 cubic feet of gas produced from a ton of coal, 6,500 cubic feet are required in the coking process. This gas contains three-fourths of 1 per cent of benzene and its homologues, which may be removed by washing the gas with petroleum, or coal tar oil; the product thus obtained is a benzolized oil containing from 2 to 3 per cent of benzene. On distillation a crude benzene light oil is obtained which contains only slight quantities of impurities, such as carbon disulphide, hydrogen sulphide, thiophene, and naphthalene, which by purification and redistillation yields a 100 per cent pure benzene,[2] suitable for converting into aniline. The extraction of the benzene and its homologues does not seriously affect the heating value of the gas, and is now being practiced to some extent. At the census of 1905 the volume of gas reported as produced and consumed in by-product ovens was 16,232,309 thousand cubic feet. The volume which would have been produced had all of the coal which was coked in that year been coked in by-product ovens is estimated at 183,025,147 thousand cubic feet.

The statistics given in Tables 48 and 50 show that the manufacture of coal tar products in the United States is an important and a growing industry, yet when compared with the same industry in Germany it sinks into insignificance.

[1] Census of Manufactures, 1905, Bulletin 65, page 18.
[2] Journal of American Chemical Society 1906, Vol. 28, page 1254.

Table 51 sets forth the imports of coal tar and of coal tar products from 1896 to 1905, as taken from Commerce and Navigation of the United States, published by the Bureau of Statistics.

TABLE 51.—*Coal tar and coal tar products—imports for consumption: 1896 to 1905.*

YEAR ENDING JUNE 30—	COAL TAR, CRUDE AND PITCH.		Coal tar products not medicinal and not colors or dyes (value).[1]	Preparations of coal tar except medicinal, colors and dyes, and products of, not specially provided for (value).
	Barrels.	Value.		
1896	139,976	$288,750	(2)	$313,943
1897	111,534	258,900	(2)	373,224
1898	89,346	158,589	$228,037	134,416
1899	26,704	60,500	393,602	221,101
1900	80,047	165,072	397,780	274,946
1901	39,062	104,547	383,559	342,116
1902	28,390	84,410	368,098	496,928
1903	57,114	141,822	425,069	544,176
1904	38,277	83,323	391,645	522,242
1905	46,057	114,500	468,352	645,830

[1] These preparations are known as benzol, toluol, naphthalin, xylol, phenol, cresol, toluidine, xylidin, cumidin, binitrotoluol, binitrobenzol, benzidin, tolidin, dianisidin, naphthol, naphthylamin, diphenylamin, benzaldehyde, benzyl chloride, resorcin, nitrobenzol, and nitrotoluol.
[2] Not reported separately.

CLASS VI.—CYANIDES.

The class of cyanides comprises potassium cyanide (cyanide of potash, or white prussiate of potash), sodium cyanide, and other simple cyanides including "cyan-salt," which is a mixture of potassium and sodium cyanides; potassium ferrocyanide (yellow prussiate of potash) and potassium ferricyanide (red prussiate of potash); the cyanates, ammonium and potassium sulphocyanates (thiocyanates or sulphocyanides), and other sulphocyanates; and cyanamids.

TABLE 52.—*Cyanides—comparative summary, with amount and per cent of decrease: 1905 and 1900.*

	CENSUS.		Decrease.	Per cent of decrease.
	1905	1900		
Number of establishments	6	12	6	50.0
Capital	$342,233	$1,250,941	$908,708	72.6
Salaried officials, clerks, etc., number	7	20	13	65.0
Salaries	$12,538	$36,475	$23,937	65.6
Wage-earners, average number	113	376	263	69.9
Total wages	$72,768	$190,568	$117,800	61.8
Miscellaneous expenses	$71,332	$173,133	$101,801	58.8
Cost of materials used	$348,490	$1,283,949	$935,459	72.9
Value of products	$586,581	$1,769,736	$1,183,155	66.9

The statistics of Table 52 show a decrease in every item, the greatest in amount being in value of products and the greatest percentage in cost of the materials used and in capital. This comparison is made between those establishments only in which the cyanides are the principal products. Since in 1900, several establishments produced a notable amount of subsidiary products, part of this reduction may be accounted for through these subsidiary industries outgrowing the cyanide industry in such establishments, and thereby carrying these establishments into another Census classification.

A better idea of the condition of the industry at the census of 1905 may be gained by bringing together the quantity and value of the cyanides produced either as a principal or as a subsidiary product, and comparing these results with similar ones for the census of 1900, the first census at which the cyanides were reported separately.

TABLE 53.—*Cyanides—quantity and value of products, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Quantity, pounds	11,196,318	8,460,989	2,735,329	32.3
Value	$1,710,823	$1,595,505	115,318	7.2
Value per pound	$0.153	$0.189		

The statistics of Table 53 show an increase in each item reported, though the increase in value is relatively less than the increase in quantity. The cyanide process for the extraction of precious metals from their ores was first made commercially successful in 1890. Its introduction into this country was slow at first, but very rapid after its utility was once demonstrated. In 1905 there were 132 establishments operating in the United States in which the cyanide process was used. When the rapid increase in the use of cyanides for this purpose and the constant increase in their use in the textile and paint industries are considered, and especially when, as shown in Table 56, it is found that the imports for consumption of cyanide of potash and of yellow prussiate of potash were less in 1905 than in 1900, while the imports of red prussiate of potash were but slightly greater, it is believed that the statistics available at the census of 1905 do not fairly represent the condition of the cyanide industry. There are probably two reasons to account for this: The first, that possibly some manufacturers, instead of making separate returns for the cyanides which they produced for sale or used in further manufacture, have reported them under "all other products;" and the second, that possibly some of the larger consumers, such as those engaged in the manufacture of printed fabrics, or paints, or inks, have begun the manufacture of the cyanides consumed by themselves in further manufacture, and, in cases where this manufacture is, relatively to the principal product of the establishment, of very minor importance, it has been found difficult to secure separate returns.

TABLE 54.—*Cyanides—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1] 11	[2] 18
Maryland		1
Massachusetts	1	1
Michigan	1	
Missouri	1	3
New Jersey	1	6
New York	2	
Ohio	2	3
Pennsylvania	3	4

[1] Includes 5 establishments engaged primarily in the manufacture of other products.
[2] Includes 6 establishments engaged primarily in the manufacture of other products.

Table 54 shows a decrease of 7, or 38.9 per cent, in the number of establishments of all classes manufacturing cyanides at the census of 1905 as compared with that of 1900. The largest decrease is in New Jersey, which returned 6 establishments in 1900 and but 1 in 1905. The other decreases are 2 in Missouri, and 1 each in Maryland, Ohio, and Pennsylvania. At the census of 1900 New Jersey ranked first and Pennsylvania second. At the census of 1905 Pennsylvania ranked first, with 3 establishments, while New York and Ohio each had 2 establishments.

TABLE 55.—*Cyanides—value of products,[1] by states: 1905 and 1900.*

STATE.	1905	1900
United States	$1,710,823	$1,595,505
New Jersey		1,053,472
Pennsylvania	434,770	303,245
Ohio		86,852
All other states[2]	1,276,053	151,936

[1] Includes value of cyanides only.
[2] Includes in 1905 Massachusetts, Michigan, Missouri, New Jersey, New York, and Ohio; in 1900, Louisiana, Tennessee, Ohio, California, Minnesota, Massachusetts, and New Jersey.

The statistics of Table 55 show that New Jersey, which is included in "all other states" in 1905, returned 66 per cent of the total value of products in 1900. In both Pennsylvania and "all other states" there is an increase at the later census. The increase in "all other states" is due partly to the fact that the statistics for New Jersey and Ohio, which in 1900 were set forth separately, can not be shown in 1905, because less than 3 establishments reported. It is worthy of note, considering the extent to which the cyanides are used in metallurgical processes in the far West, that their manufacture is largely confined to the Eastern states.

At the census of 1900 there were reported[1] as used in this industry, 9,315,080 pounds of potassium carbonate, valued at $279,602; 3,456 tons of hoofs and of horn waste, valued at $87,502; 19,417 tons of scrap leather, valued at $150,213; 1,200 tons of spent iron oxide from gas works, valued at $3,000; 300,000 pounds of sodium, valued at $93,183; 2,400 bushels of lime, valued at $480; scrap iron, valued at $9,520; and 2,401,180 pounds of potassium ferrocyanide.

At the census of 1905 there were reported as used 9,981,700 pounds of potassium carbonate, valued at $215,664; 1,279,447 pounds of sodium carbonate, valued at $5,037; 13,478 tons of scrap leather, valued at $87,253; 3,248 tons of spent iron oxide, valued at $25,146; 2,478,966 pounds of sodium; 40,034 bushels of lime, valued at $6,112; 175 tons of scrap iron, valued at $7,000; and 54,966 pounds of potassium ferrocyanide, valued at $7,695.

Among the cyanides reported at the census of 1900[1] there were 6,165,407 pounds of potassium ferrocyanide, valued at $994,014, and 2,317,280 pounds of so-called potassium cyanide, valued at $601,491. At the census of 1905 there were reported produced, 5,027,264

[1] Twelfth Census, Manufactures, Part IV, page 553.

pounds of potassium ferrocyanide, valued at $683,277; 78,584 pounds of potassium cyanide, valued at $17,438; and 6,197,470 pounds of sodium cyanide, valued at $923,210.

At a meeting of the Fifth International Congress of Applied Chemistry held in Berlin in 1903, Mr. George Beilby said that the whole "turnover" of the European trade at its best, in the cyanide industry, did not exceed $2,919,000 a year, and that the total net profit in the best year was probably under, rather than over, $486,650. He estimated that the consumption of European-made cyanide throughout the world, not counting that exported to America, was normally about 5,500 tons per annum, while the capacity of the then existing works in Germany, France, and Great Britain was 12,600 tons, and with the then proposed additions would soon be 15,700 tons per annum. He said also that on account of the congestion of the European market during the two or three previous years, relief had been sought through exports to America at a low price. He referred to the new industrial sources of the cyanides, such as the "Schlempe," or residue of the beet root molasses refineries, which through Bueb's process had been made to yield a gas very much richer in ammonia and hydrocyanic acid than coal gas; to the improved processes for the production of the cyanides and ferrocyanides from coal gas; to the improved Gelée process for the production of ammonium sulphocyanide from carbon disulphide and ammonia, and its further conversion into ferrocyanide; and to the Siepermann and his own process for obtaining cyanide from potassium carbonate, charcoal, and ammonia. At the same Congress, Dr. F. Rössler traced the development of the synthetic processes of manufacture. Descriptions of all these processes are given in great detail in the recently published book of Robine and Lenglen.

The most important discovery in the cyanide industry, in the interval which has elapsed since the last census, is in the manufacture of calcium cyanamid, or lime nitrogen, by the process of Frank and Caro, which consists practically of the passage of nitrogen over heated calcium carbide, for in this is found a practical and economical process for the fixation of atmospheric nitrogen, a further use for calcium carbide, and a valuable and very extensive field for the utilization of liquid air; while the product itself is a valuable fertilizer, which may be used directly as such. Furthermore, by very simple means a considerable number of useful chemicals may be produced from it, among which may be mentioned potassium and other cyanides, ammonia and ammonium sulphate or other ammoniacal salts, urea, guanidin, dicyandiamid, and nitric acid. Since this process was discovered, between 8,000 and 9,000 gross tons of lime nitrogen have been manufactured by it, and for more than a year past a plant having a capacity of 3,750 gross tons per year has been in operation at Piano d'Orta, Italy. This plant is engaged in enlarging its capacity to 15,000 gross tons per year, while other plants having a combined capacity of 26,250 gross tons per year are under construction in Europe. There is little doubt but that this industry will have been established in this country by the time of the taking of the next census, and that its stimulating effect on related industries will be noted.

Table 56 shows the imports of cyanides from 1891 to 1905, as taken from Commerce and Navigation of the United States, published by the Bureau of Statistics.

TABLE 56.—*Cyanides—imports for consumption: 1891 to 1905.*

YEAR ENDING JUNE 30—	YELLOW PRUSSIATE OF POTASH.		RED PRUSSIATE OF POTASH.		CYANIDE OF POTASH.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1891	2,223,154	$368,366	35,826	$10,650		
1892	1,302,632	232,058	35,933	11,111		
1893	1,047,910	206,259	16,679	5,743		
1894	599,103	114,826	11,125	3,339		
1895	878,727	161,009	26,703	7,593		
1896	1,056,562	157,457	30,390	8,579		
1897	3,252,931	359,037	59,087	14,893	16,232	$4,190
1898	1,340,305	132,508	77,246	18,674	549,697	120,252
1899	1,809,089	204,974	62,697	15,211	1,102,780	253,613
1900	1,771,394	224,274	53,716	12,954	2,064,974	444,703
1901	1,609,358	218,909	30,262	7,357	2,029,994	475,833
1902	594,295	66,756	47,200	11,355	3,054,254	595,587
1903	1,315,051	119,859	57,169	13,757	3,019,462	549,628
1904	1,736,564	156,275	55,624	13,508	1,513,849	279,204
1905	1,165,192	103,193	60,699	14,453	1,624,372	260,208

BIBLIOGRAPHY.

BEILBY, GEORGE. *On the Present Position of the Cyanide Industry*, Bericht V. Internationaler Kongress für Angewandte Chemie, Berlin, 1904, vol. 1, page 628.

ERLWEIN, G. *Ueber ein neues Ausgangsmaterial (Calcium cyanamid) zur Herstellung von Alkalicyaniden*, Bericht V. Internationaler Kongress für Angewandte Chemie, Berlin, 1904, vol. 1, page 646.

FRANKLAND, PERCY F. *The Utilization of Atmospheric Nitrogen for Industrial Purposes*, Journal of Society of Chemical Industry, 1907, vol. 26, page 175.

GLASER, C. *Report on an Examination of Calcium Cyanamid (lime nitrogen)*, New York, 1907.

GUYE, PHILLIPPE A. *The Electro-chemical Problem of the Fixation of Nitrogen*, Journal of Society of Chemical Industry, 1906, vol. 25, page 567.

MUNPOE, CHARLES E. *Report on Calcium Cyanamid (lime nitrogen)*, New York, 1907.

ROBINE, R. and LENGLEN, M. *The Cyanide Industry; Theoretically and Practically Considered*, translated by J. Arthur Le Clerc with an appendix by Charles E. Munroe, New York, 1906.

RÖSSLER, F. *Cyan unter besonderer Berucksichtigung der synthe tischen Cyanidverfahren*, Bericht V. Internationaler Kongress für Angewandte Chemie, Berlin, 1904, vol. 1, page 638.

CLASS VII.—WOOD DISTILLATION.

The class of wood distillation comprises wood alcohol (methyl alcohol), both crude and refined, acetate of lime (calcium acetate), both brown and gray, acetate of soda, acetic acid, charcoal, formaldehyde, acetone, pyroligneous acid, pyrolignite of iron, dye liquors, wood creosote, wood oil, wood tar, wood ashes, spirits of turpentine, as produced by the distillation of wood, pine oil, red liquor, wood preservative, tar

oil, and pine tar. Naturally spirits of turpentine and rosin, with other products, obtained from the distillation of the exuded turpentine of the long leaf pine are reported under the classification of "turpentine and rosin."

Table 57.—*Wood distillation—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	141	102	39	38.2
Capital	$10,506,979	$6,729,127	$3,777,852	56.1
Salaried officials, clerks, etc., number	301	235	66	28.1
Salaries	$297,528	$213,025	$84,503	39.7
Wage-earners, average number	2,272	1,556	716	46.0
Total wages	$1,066,786	$700,484	$366,302	52.3
Miscellaneous expenses	$631,437	$368,305	$263,132	71.4
Cost of materials used	$4,847,770	$3,455,015	$1,392,755	40.3
Value of products	$7,813,483	$6,001,023	$1,812,460	30.2

Table 57 shows a marked increase in every item, the largest percentage of increase being in the item of miscellaneous expenses. A more significant increase is in the item of capital, which shows nearly double the percentage of increase that the value of products does. A part of this increase is due to the introduction into the South and West of distillation processes for the treatment of pine wood and stumpage.

Statistics for this industry were reported separately at the census of 1880 and have been reported separately at each subsequent census. The figures given in 1880 were for crude wood alcohol, acetate of lime, and charcoal, and for purposes of comparison the figures for these items are shown in Tables 58 and 59 for each census. Since 1880, following the general trend of the development of chemical manufactures, a number of establishments manufacturing these crude products have used the crude alcohol for the production of refined alcohol, which is the form in which this product is offered for sale. In the process of refining, the crude alcohol is reduced in volume by about 20 per cent. To ascertain the total volume of crude alcohol produced by wood distillation processes at any given census, it is necessary, not only to add together all of the crude alcohol produced as a subsidiary product, but also to include that which is consumed in the wood distillation establishments in further manufacture. Frequently this is not reported, but, knowing the volume of refined alcohol produced, the volume of the crude alcohol can be determined with a close approach to accuracy by multiplying the quantity of refined alcohol by 1.25. Such a method of procedure was followed at the census of 1890, and has been followed at each subsequent census.

Table 58.—WOOD DISTILLATION—CRUDE PRODUCTS: 1880 TO 1905.

CENSUS.	Number of establishments.	WOOD ALCOHOL (CRUDE).		ACETATE OF LIME.		CHARCOAL.	
		Gallons.	Value.	Pounds.	Value.	Bushels.	Value.
1905	129	[1] 8,282,286	[1] $2,672,507	110,383,997	$1,527,733	[2] 40,944,190	[2] $2,038,514
1900	93	4,945,963	1,976,986	86,826,000	981,286	17,154,302	726,672
1890	53	1,116,075	688,764	26,778,415	315,430		
1880	17		86,274	6,593,009	156,892		31,770

[1] Includes 1,468,028 gallons, with an assigned value of $470,546, consumed in establishments where manufactured.
[2] Includes 11,026,978 bushels of charcoal, with an assigned value of $551,349, consumed in establishments where manufactured.

Table 59.—WOOD DISTILLATION—CRUDE PRODUCTS, INCREASE AND PER CENT OF INCREASE: 1880 TO 1905.

KIND.	INCREASE.						PER CENT OF INCREASE.					
	1900 to 1905		1890 to 1900		1880 to 1890		1900 to 1905		1890 to 1900		1880 to 1890	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Wood alcohol (crude), gallons	3,336,323	$695,521	3,829,888	$1,288,222		$602,490	67.5	35.2	343.2	187.0		698.3
Acetate of lime, pounds	23,557,997	546,447	60,047,585	665,856	20,185,406	158,538	27.1	55.7	224.2	211.1	306.2	101.0
Charcoal, bushels	23,789,888	1,311,842					138.7	180.5				

Table 59 shows an increase in every item at each census, indicating a constant progress in every branch of the industry.

Table 60 shows that the number of establishments has increased by 39, or 35.1 per cent, in 1905 as compared with 1900, the greatest increase in any one state being in Georgia, which reported 9 in 1905 as compared with none in 1900. The increase in Michigan was 7, in South Carolina 5, and in New York, North Carolina, and Pennsylvania 4 each. It will be observed that a large part of the gain is to be credited to the Southern states.

TABLE 60.—*Wood distillation—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1] 150	[1] 111
Alabama	1	....
Connecticut	1	1
Delaware	....	1
Florida	4	....
Georgia	9	....
Indiana	....	1
Kentucky	1	....
Louisiana	2	....
Massachusetts	2	4
Michigan	13	6
Minnesota	1	....
Mississippi	1	....
Missouri	1	....
New York	32	28
New Jersey	2	4
North Carolina	7	3
Ohio	....	1
Pennsylvania	64	60
South Carolina	5	....
Tennessee	....	1
Vermont	2	1
Washington	1	....
Wisconsin	1	....

[1] Includes 9 establishments engaged primarily in the manufacture of other products.

Ranked by the number of establishments, Pennsylvania stood first at each census, New York second, and Michigan third. Georgia in 1905 stands fourth, North Carolina fifth, South Carolina sixth, and Florida seventh. No other state reported more than 2 establishments.

TABLE 61.—*Wood distillation—value of crude products,[1] by states: 1905 and 1900.*

STATE.	1905	1900
United States	$6,538,769	$3,833,266
Georgia	78,313	....
Michigan	1,343,163	505,069
New York	1,222,383	786,252
North Carolina	74,501	18,409
Pennsylvania	3,127,350	2,339,536
South Carolina	15,419	....
All other states	677,640	184,000

[1] Includes crude products manufactured by establishments engaged primarily in the manufacture of other products.

At the census of 1900 Pennsylvania ranked first in the value of its crude products, New York second, and Michigan third. At the present census Pennsylvania ranks first, Michigan second, and New York third. At the census of 1900 the value of the crude products of Pennsylvania, New York, and Michigan amounted to $3,630,857, and constituted 94.7 per cent of the total for the United States, while at the census of 1905 it amounted to $5,692,896, and constituted 87.1 per cent of the total.

At the census of 1900 there were 9 establishments reporting the production of the crude material and the refining of the alcohol in the same factory. These establishments produced 637,856 gallons of refined alcohol, valued at $370,513; 5,124,000 pounds of acetate of lime, valued at $54,928; and 2,726,120 bushels of charcoal, valued at $114,663. At the census of 1905 the number of establishments thus reporting was 8, which produced 1,210,736 gallons of refined alcohol, valued at $503,884; 10,718,089 pounds of acetate of lime, valued at $110,517; and 9,275,543 bushels of charcoal (including 3,035,100 bushels produced and consumed) valued at $536,926.

The quantity of wood used in this industry at the census of 1900 was 490,939 cords, valued at $1,241,972, or an average of $2.53 per cord. Of this, 3,134 cords, valued at $7,822, consisted of soft wood, namely, long leaf pine. The quantity of wood used at the census of 1905 was 1,049,503 cords, valued at $3,755,627, or an average of $3.58 per cord. Of this, 31,431 cords, valued at $112,742, consisted of soft wood, principally long leaf pine. It was estimated in 1900, on the assumption that one man could cut on the average $1\frac{1}{2}$ cords of wood per day, that the cutting of the wood required for the wood distillation industry for that year gave employment to 3,273 men for one hundred days each. The cutting of the wood required for the census year 1905 at the same rate would have given employment to 6,997 men for one hundred days each.

Up to the census of 1900 the wood distillation industry was confined to the distillation of the hardwoods, but at the census of 1900, 4 establishments were reported as being engaged in the distillation of pine wood, and at the census of 1905, 31 establishments were reported as being so engaged. The products of the distillation of pine wood are so unlike those of hardwoods that the statistics of the two industries should be reported separately. This was not done in the report on chemicals and allied products at the census of 1900, because the quantity and value of such products were relatively insignificant, but the growth of the industry requires that this now be done.

TABLE 62.—*Pine wood distillation products: 1905 and 1900.*

KIND.	1905		1900	
	Quantity.	Value.	Quantity.	Value.
Total	....	$376,874	....	$31,148
Wood alcohol, gallons	18,000	1,800	62,238	7,570
Pyroligneous acid, gallons	277,500	8,005	12,296	316
Turpentine spirits, gallons	409,685	176,521	....	....
Tar, gallons	1,292,983	75,923	....	....
Tar oil, gallons	176,849	8,076	170,960	13,677
Charcoal, bushels	342,320	25,046	1,138	137
All other kinds	....	81,508	....	9,448

Table 62 shows an increase of $345,726, or of 1,109.9 per cent in the total value of products for 1905 as compared with 1900, and an increase also in every separate item for which a comparison is made except in the quantity and value of the wood alcohol and in the value of tar oil. Furthermore, an increased number of products is shown for 1905 as compared with 1900, which indicates a marked improvement in manufacturing methods and a more complete utilization of the distillation product.

Table 63 shows that the increase in the quantity of refined wood alcohol at the census of 1900 over that of 1890 was 2,871,798 gallons, or 1,726.4 per cent, and that

the increase at the census of 1905, as compared with that of 1900, was 2,879,013 gallons, or 94.8 per cent, in quantity, and $1,158,727, or 50. 4 per cent, in value.

The quantity of lime used at the census of 1900 was 524,508 bushels, valued at $86,635, or an average of $0.165 per bushel, and at the census of 1905, 811,902 bushels, valued at $120,181, or an average of $0.148 per bushel.

TABLE 63.—*Production of refined wood alcohol: 1890 to 1905.*

CENSUS.	Number of establishments.	Gallons.	Value.
1905	15	5,917,153	$3,455,625
1900	18	3,038,140	2,296,898
1890	4	166,342	

The quantity of caustic soda returned as used at the census of 1900 was 1,270,846 pounds, valued at $33,717, and at the census of 1905, 346,150 pounds, valued at $4,158. This very considerable shrinkage is believed to be due to the failure of refiners to make separate returns for this item of materials used. Chloride of lime, sulphuric acid, and muriatic acid were also reported at each census among the materials used, but the quantities were not sufficiently large to warrant them being presented separately.

In addition to the principal products of this industry there were returned at the census of 1900 as subsidiary products 182,446 gallons of pyroligneous acid, valued at $9,481; 308,400 gallons of dye liquors, valued at $29,440; and sundries, such as wood, creosote, wood oil, ashes, and tar to the value of $71,452. Many of these substances returned at the census of 1905 are accounted for in Table 61, the pine distillation industry having increased so greatly since 1900 as to warrant separate presentation. But there were also returned from the hardwood distillation in 1905 as subsidiary products 6,600 gallons of pyroligneous acid, valued at $566, and 55,960 gallons as produced and consumed; also 63,100 gallons of pyrolignite of iron, valued at $4,446; 22,000 gallons of red liquor, valued at $2,150; 28,000 gallons of iron liquor, valued at $345; 388,760 bushels of wood ashes, valued at $18,305; 62,700 pounds of acetone, valued at $6,897; and creosote to the value of $209.

The methods of manufacture followed in this industry were described in the report on chemicals and allied products for the census of 1900. The chief development of the intervening period has been in pine wood distillation in which processes for the utilization of pine stumps and of pines killed in the extraction of turpentine have been sought. Many of the establishments have failed to make a commercial success of this industry because of their inability so to conduct the process as to keep the products of the destructive distillation of the wood separate from the spirits of turpentine, but apparently this problem has now been solved satisfactorily, and the resources of the country in spirits of turpentine have been increased materially.

Table 64 gives the exports and imports of wood distillation products from 1891 to 1905, as taken from Commerce and Navigation of the United States, published by the Bureau of Statistics.

TABLE 64.—*Wood distillation products—exports and imports: 1891 to 1905.*

YEAR ENDING JUNE 30—	EXPORTS.				IMPORTS.	IMPORTS FOR CONSUMPTION.	
	Wood alcohol.		Acetate of lime.		Charcoal (value).	Acetic or pyroligneous acid.	
	Gallons.	Value.	Pounds.	Value.		Pounds.	Value.
1891					$56,020	10,946	$1,036
1892					48,029	12,280	2,302
1893					51,634	18,421	2,795
1894					40,249	22,244	3,959
1895					20,272	92,889	8,938
1896					42,970		
1897					32,106		
1898	385,938	$199,230	37,496,288	$537,856	2,404	127,949	9,776
1899	727,062	414,875	48,987,511	700,900	(1)	202,838	14,467
1900	540,799	320,306	47,790,765	776,413	(1)	292,891	19,189
1901	919,504	476,582	61,296,544	1,101,037	(1)	291,801	21,182
1902	626,925	338,619	60,488,509	962,265	(1)	139,028	14,629
1903	833,629	452,892	59,449,811	987,067	(1)	125,983	11,623
1904	1,194,466	585,359	64,256,945	1,103,389	14,844	142,620	9,262
1905	1,097,451	603,385	55,170,131	1,245,776	478	141,662	18,058

[1] Not reported separately.

CLASS VIII.—FERTILIZERS.

The class of fertilizers comprises superphosphate (acid phosphate), which is a mixture of the hydrated mono-calcium tetra-hydrogen, and di-calcium di-hydrogen phosphates with hydrated calcium sulphate; double superphosphate, which is hydrated mono-calcium tetra-hydrogen phosphate; ammoniates or substances containing nitrogen; ammoniated superphosphate, which is a mixture of ammoniates with superphosphate; complete fertilizers, which consist of mixtures of superphosphate, potash salts, and ammoniates; bones, tankage, and offal; ground bone; fish scrap; cottonseed meal; basic calcium nitrate; and cyanamid, or lime nitrogen. A comparison of the substances above enumerated with the materials used indicates that several of the substances are identical. This arises from the fact that each of these substances, as used in the manufacture of compounded fertilizers, possesses of itself fertilizing properties, and is sometimes used as fertilizer. This is true even of phosphate rock, which, under some circumstances is ground fine and applied to the soil, also of the phosphatic slag, Thomas slag, or Belgian phosphate, produced in the basic process of manufacturing steel, and of gypsum, or plaster. Where such substances are reported as being manufactured for sale as fertilizers, they are entered in this classification, together with special compositions not provided for above, under "all other fertilizers." Frequently they belong to the class of products consumed in further manufacture in the establishment where they were produced.

TABLE 65.—*Fertilizers—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	400	422	[1] 22	[1] 5.2
Capital	$69,023,264	$60,685,753	$8,337,511	13.7
Salaried officials, clerks, etc., number	1,618	1,712	[1] 94	[1] 5.5
Salaries	$1,940,712	$2,124,972	[1] $184,260	[1] 8.7
Wage-earners, average number	14,201	11,581	2,620	22.6
Total wages	$5,142,147	$4,185,289	$956,858	22.9
Miscellaneous expenses	$4,919,824	$3,734,285	$1,185,539	31.7
Cost of materials used	$39,343,914	$28,958,473	$10,385,441	35.9
Value of products	$56,632,853	$44,657,385	$11,975,468	26.8

[1] Decrease.

The data of Table 65 shows an increase in every item for 1905 as compared with 1900, except in those of the number of establishments, the number of salaried officials, clerks, etc., and the amount of salaries paid. As all the other items increased by from 13.7 to 35.9 per cent, there appears to have been consolidations in this industry in the interval which has elapsed since the census of 1900. The largest absolute increase appears in the value of products, and the largest percentage of increase, in cost of materials used.

TABLE 66.—*Fertilizers[1]—quantity and value of products, with amount and per cent of increase: 1905 and 1900.*

KIND.	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Superphosphates:				
Tons	[2] 1,670,978	[3] 1,480,414	190,564	12.9
Value	[2] $16,495,206	[3] $13,575,393	$2,919,813	21.5
Ammoniated superphosphates:				
Tons	781,354	143,648	637,706	443.9
Value	$13,020,825	$2,462,888	$10,557,937	428.7
Complete fertilizers:				
Tons	1,603,847	1,478,826	125,021	8.5
Value	$31,305,057	$26,318,995	$4,986,062	18.9
All other fertilizers:				
Tons	419,803	327,522	92,281	21.9
Value	$4,826,656	$4,723,430	$103,226	2.2

[1] Not including cottonseed meal.
[2] Includes 884,211 tons of superphosphates, with an assigned value of $8,674,110, consumed in establishments where manufactured.
[3] Includes 543,406 tons of superphosphates, with an assigned value of $4,983,033, consumed in establishments where manufactured.

From Table 66 it is seen that by far the largest increase in quantity and in value of the different kinds of fertilizers was in ammoniated superphosphates, which have increased in both respects more than 400 per cent. The marked relative increase in the value of complete fertilizers is brought out strikingly by the percentage column, an increase in quantity of only 8.5 per cent being accompanied by an increase in value of 18.9 per cent. Besides compounded fertilizers not provided for under ammoniated superphosphates or complete fertilizers, ground gypsum, marl, phosphate rock, bones or slag, wood ashes, leached and unleached, and other such materials are included under "all other fertilizers." Evidently much of such material which is produced and used escapes census enumeration, and returns under this heading will necessarily lack uniformity at the different censuses.

TABLE 67.—*Fertilizers—number of establishments,[1] by states and territories: 1905 and 1900.*

STATE OR TERRITORY.	1905	1900
United States	[2] 553	[3] 475
Alabama	21	21
Alaska	1	......
California	20	9
Colorado	3	......
Connecticut	11	9
Delaware	9	11
District of Columbia	4	7
Florida	8	7
Georgia	57	45
Illinois	25	12
Indiana	22	16
Iowa	6	1
Kansas	11	3
Kentucky	6	4
Louisiana	4	6
Maine	4	3
Maryland	41	42
Massachusetts	15	10
Michigan	2	1
Minnesota	8	1
Mississippi	5	3
Missouri	7	4
Nebraska	5	1
Nevada	1	......
New Jersey	28	30
New York	31	37
North Carolina	28	20
Ohio	24	28
Oregon	2	1
Pennsylvania	56	66
Rhode Island	2	1
South Carolina	20	24
Tennessee	12	5
Texas	4	2
Virginia	39	42
Washington	4	1
West Virginia	2	2
Wisconsin	4	......
Wyoming	1	......

[1] Does not include establishments making cottonseed meal.
[2] Includes 153 establishments engaged primarily in the manufacture of other products.
[3] Includes 53 establishments engaged primarily in the manufacture of other products.

Table 67 shows an increase in the number of establishments in 27 states and a decrease in 10, the actual increase for the whole United States being 78. The increase in Illinois was 13, in Georgia 12, and in California 11. There was a decrease of 10 in Pennsylvania; of 6 in New York; and of 4 each in Ohio and South Carolina. Georgia, which held the second place in 1900, takes the first place in 1905, and Pennsylvania, which held the first place in 1900, drops to second place. Maryland, Virginia, New York, and New Jersey now hold third, fourth, fifth, and sixth places, respectively. North Carolina passes from the ninth place to the sixth, sharing this place with New Jersey in 1905. Illinois rises from the eleventh to the seventh place and Indiana from the tenth to the ninth. Ohio falls from the sixth to the eighth place. Alabama falls from the eighth to the tenth place. California rises from the fourteenth to share with South Carolina, which falls from the seventh to the eleventh place. Massachusetts rises from the thirteenth to the twelfth and Tennessee from the seventeenth to the thirteenth place. Connecticut remains in the fourteenth place, sharing it, at the census of 1905, with Kansas, which has risen from the nineteenth place. Delaware falls from the twelfth to the fifteenth place, and Florida from the fifteenth to the sixteenth, sharing this place with Minnesota, which has risen from below the line of less than 3 estabishments. Missouri rises from the eighteenth to the seventeenth place.

Kentucky retains the eighteenth place, but shares it at the present census with Iowa, which has risen from below the line. Mississippi retains the nineteenth, but shares it with Nebraska, which has risen from below the line. Maine falls from the nineteenth to the twentieth. The District of Columbia has fallen from the fifteenth place, Louisiana from the sixteenth place, sharing the twentieth place with Texas and Washington, which rise from below the line, and with Wisconsin, which first appears at this census. Colorado, which also first appears at this census, occupies the twenty-first place. At the census of 1900 there were 25 states in which there were 3 or more establishments and 9 states in which there were less than 3. At the census of 1905 there were 32 states in which there were 3 or more and 7 states in which there were less than 3 establishments.

Although a consideration of the returns of the establishments primarily engaged in the manufacture of fertilizers as set forth in the comparative summary in Table 65 indicates that there has been a concentration of the industry in the interval from 1900 to 1905, yet when the inquiry is extended so as to include also those establishments which manufacture fertilizers as a secondary product, it becomes evident that this industry has, as a fact, become more widely diffused.

Table 68 shows that at both censuses the South Atlantic division leads in both quantity and value of products, with the North Atlantic second, the South Central third, and the North Central fourth. At the census of 1900 the product of the Western division exceeded that of "all other states" in value but was less in quantity. At the census of 1905 the product of the Western division stood fifth in both quantity and value.

TABLE 68.—*Fertilizers—quantity and value of products, by states and geographic divisions: 1905 and 1900.*

STATE OR DIVISION.	1905		1900	
	Quantity (tons).	Value.	Quantity (tons).	Value.
United States	3,591,771	$56,973,634	2,887,004	$42,097,673
North Atlantic division	709,875	12,320,747	685,893	11,978,666
Maine	4,613	74,991	1,828	27,902
Massachusetts	82,598	1,972,988	83,733	2,108,575
Connecticut	19,506	609,705	11,077	313,610
New York	106,010	1,695,949	164,266	2,610,435
New Jersey	285,613	4,523,675	247,144	3,820,189
Pennsylvania	211,535	3,443,439	177,845	3,097,955
South Atlantic division	1,924,623	28,039,923	1,531,688	19,462,816
Delaware	13,673	225,348	49,942	634,213
Maryland	523,493	6,715,402	386,133	5,213,925
District of Columbia	(1)	(1)	3,859	76,480
Virginia	250,877	3,902,938	258,474	3,325,542
North Carolina	181,330	2,865,501	139,582	1,727,270
South Carolina	254,408	3,498,127	388,572	4,657,275
Georgia	629,250	9,242,836	278,982	3,331,469
Florida	71,592	1,589,771	26,144	496,642
North Central division	405,236	7,487,078	258,726	4,349,157
Ohio	149,855	2,262,711	103,814	1,562,638
Indiana	30,022	447,158	11,668	238,161
Illinois	155,602	2,758,473	104,120	1,842,300
Wisconsin	1,419	31,081	(2)	(2)
Minnesota	7,503	156,749	(1)	(1)
Iowa	5,686	121,540	(1)	(1)
Missouri	17,078	369,547	8,753	156,115
Nebraska	16,750	545,369	(1)	(1)
Kansas	21,321	794,450	30,371	549,943
South Central division	512,482	8,001,153	352,778	5,053,564
Kentucky	32,137	541,553	17,315	295,520
Tennessee	159,593	2,663,062	93,054	1,464,788
Alabama	163,221	2,367,258	139,282	1,944,283
Mississippi	60,372	933,877	37,704	492,772
Louisiana	88,916	1,289,659	65,423	856,201
Texas	8,243	205,744	(1)	(1)
Western division	28,160	867,383	22,131	636,687
California	28,160	867,383	22,131	636,687
All other states [3]	11,395	257,350	35,788	616,783

[1] Included in "all other states."
[2] Not reported.
[3] Includes in 1905 Alaska, Colorado, District of Columbia, Michigan, Nevada, Oregon, Rhode Island, Washington, West Virginia, and Wyoming; and in 1900, Iowa, Michigan, Minnesota, Nebraska, Oregon, Rhode Island, Texas, Washington, and West Virginia.

TABLE 69.—FERTILIZERS—NUMBER OF ESTABLISHMENTS AND QUANTITY AND VALUE OF PRODUCTS, WITH AMOUNT AND PER CENT OF INCREASE: 1860 TO 1905.

CENSUS.	Number of establishments.	Quantity (tons).	Value.	INCREASE.			PER CENT OF INCREASE.		
				Number of establishments.	Quantity (tons).	Value.	Number of establishments.	Quantity (tons).	Value.
1905	553	3,591,771	$56,973,634	78	704,767	$14,875,961	16.2	24.7	35.3
1900	475	2,887,004	42,097,673	83	988,198	6,577,832	21.2	52.0	18.5
1890	392	1,898,806	35,519,841	114	1,171,353	15,598,441	41.0	161.0	78.3
1880	278	727,453	19,921,400	152	....	14,106,282	120.6	....	242.6
1870	126	....	5,815,118	79	....	4,923,774	168.1	....	552.4
1860	47	....	891,344	....	....	....	....	....	....

The statistics of Table 69 show a constant increase in every item. As compared with the returns for 1860 the product has at the census of 1905 increased $56,082,290, or 6,291.9 per cent in value, and as compared with the returns of the census of 1880, which is the first at which the quantity is recorded, it has increased 2,864,318 tons, or 393.7 per cent, in quantity.

Table 70 sets forth the materials used in the principal establishments only, at the censuses of 1900 and 1905, together with the amount and per cent of increase.

TABLE 70.—*Fertilizers*[1]*—quantity and cost of principal materials used, with amount and per cent of increase: 1905 and 1900.*

KIND.	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Fish:				
Thousands	923,305	458,963	464,342	101.2
Cost	$880,142	$183,542	$696,600	379.5
Kainit:				
Tons	190,493	54,700	135,793	248.3
Cost	$1,891,073	$520,833	$1,370,240	263.1
Limestone:				
Tons	20,281	7,158	13,123	183.3
Cost	$10,731	$7,322	$3,409	46.6
Phosphate rock:				
Tons	888,571	787,927	100,644	12.8
Cost	$4,244,554	$3,554,174	$690,380	19.4
Pyrites:				
Tons	342,962	288,778	54,184	18.8
Cost	$2,020,759	$1,466,285	$554,474	37.8
Sulphur:				
Tons	4,210	12,728	[2]8,518	[2]66.9
Cost	$92,234	$268,670	[2]$176,436	[2]65.7
Lime:				
Bushels	22,131	13,130	9,001	68.6
Cost	$3,475	$887	$2,588	291.8
Potash salts:				
Tons	122,107	....	....	....
Cost	$3,606,701	$3,098,400	$508,301	16.4
Nitrate of potash:				
Tons	1,160	884	276	31.2
Cost	$39,039	$32,156	$6,883	21.4
Nitrate of soda:				
Tons	42,213	19,518	22,695	116.3
Cost	$1,760,432	$709,841	$1,050,591	148.0
Wood ashes:				
Bushels	17,083	....	....	....
Cost	$2,050	....	....	....
Sulphuric acid:				
Tons	197,865	231,527	[2]33,662	[2]14.5
Cost	$1,084,304	$1,355,382	[2]$271,078	[2]20.0
Superphosphate:				
Tons	320,559	286,898	33,661	11.7
Cost	$2,912,010	$2,176,245	$735,765	33.8
Ammoniates:				
Tons	125,888	....	....	....
Cost	$2,445,051	....	....	....
Ammonium sulphate:				
Tons	10,540	3,678	6,862	186.6
Cost	$600,856	$186,609	$414,247	222.0
Common salt:				
Tons	2,406	481	1,925	400.2
Cost	$13,245	$2,211	$11,034	499.1
Cottonseed meal	$2,376,448	$167,410	$2,209,038	1,319.5
Bones, tankage, etc	$5,094,149	$9,766,735	[2]$4,672,586	[2]47.8

[1] Includes materials used in principal establishments only.
[2] Decrease.

The statistics presented in Table 70 show an increase in every item except in the quantity and value of sulphur, in the quantity and value of sulphuric acid, and in the value of bones, tankage, etc. Sulphur is used in the fertilizer industry in the manufacture of sulphuric acid, which is consumed in the manufacture of superphosphate from bones or from phosphate rock, and, as pointed out when discussing the manufacture of sulphuric acid under Class I, it is good practice to substitute pyrites for sulphur in the manufacture of the same, especially when it is to be used in the manufacture of superphosphate. Inspection of the table shows that while there was a decrease of 8,518 tons in the quantity of sulphur used, there was an increase of 54,184 tons in the quantity of pyrites used. The decrease in the quantity and value of the sulphuric acid purchased is accompanied also by a decrease in the quantity and value of the sulphuric acid produced for sale by these principal establishments, for, while in 1900 there were reported as thus produced 2,816 tons of 66° Baumé acid, valued at $50,004, and 66,952 tons of 50° Baumé acid, valued at $387,921, in 1905 there were reported as thus produced but 337 tons of 66° Baumé acid, valued at $9,521, and 23,997 tons of 50° Baumé acid, valued at $185,327. These statistics together with those for pyrites and sulphur combine to show that the practice of consuming in further manufacture the sulphuric acid made is increasing. The decrease in the value of the bones, tankage, etc., used may be partly accounted for by the separate presentation of the statistics for ammoniates at the census of 1905. As bones and tankage furnish phosphorus and nitrogen, the decrease in this item as regards its phosphorus contents is offset by the increase in the quantities of fish and phosphate rock used, and as regards its nitrogen contents, by the increase in the quantities of nitrate of potash, nitrate of soda, ammonium sulphate and cottonseed meal used. It is probable that much of the blood and bone tankage is now prepared for marketing by drying and pulverizing, and sold for use as a fertilizer without further compounding.

It should be definitely borne in mind that the materials enumerated in Table 70 are only those which were reported as used in principal establishments, while the statistics for production given in Table 66 include both the products of establishments in which the manufacture of fertilizers is a primary industry and those in which it is a secondary industry. But in establishments such as those engaged in slaughtering and meat packing, which alone returned at the census of 1905 a product of 211,137 tons of complete fertilizers, valued at $4,397,626, and 157,937 tons of fertilizing material, such as tankage, valued at $2,806,435, the materials used in the fertilizers other than the animals from which the blood, tankage and offal were obtained, formed so small a proportion of the whole that they were not enumerated separately and therefore could not be directly ascertained for insertion in Table 70. It is true that in the past complete fertilizers have averaged 8 parts of superphosphates to 2 parts of potash salts and 2 of ammoniates, the proportions being based upon the phosphorus, potassium, and ammonia contents or equivalents, but as in recent years there has been an increasing demand for compositions of the ratio of 10 : 2 : 2 any estimate of the quantity of these substances used must be quite rough, especially as by ammoniates in this connection all substances containing nitrogen are meant.

The quantities of materials available for use may be indicated by the fact that the by-product coke industry produced 15,773 tons of ammonium sulphate in 1905, while the principal fertilizer establishments used but 10,540 tons. In the same year the cottonseed-oil factories produced $27,428,762 worth of cottonseed meal and cake, while the principal fertilizer establishments used but $2,376,448 worth, or less than one-tenth of the total production.

The slaughterhouse fertilizing materials are marketed in three grades known to the trade as "blood,"

which is merely dried blood containing approximately 14 per cent of nitrogen; "tankage No. 1," containing approximately 8.2 per cent of nitrogen; and "tankage No. 2," containing nearly 5.8 per cent of nitrogen.

Table 71 gives the imports of fertilizers for the years 1890, 1900, and 1905 as taken from Commerce and Navigation of the United States, published by the Bureau of Statistics.

TABLE 71.—FERTILIZERS—IMPORTS FOR CONSUMPTION: 1890 TO 1905.

YEAR ENDING JUNE 30—	PHOSPHATE, CRUDE OR NATIVE.		KIESERITE, KYANITE, OR CYANITE, AND KAINITE.		GUANO.		BONE DUST OR ANIMAL CARBON AND BONE ASH, FIT ONLY FOR FERTILIZING PURPOSES.		APATITE.		ALL OTHER SUBSTANCES, NOT ELSEWHERE SPECIFIED.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
1890	31,179	$309,764	62,871	$422,225	8,432	$111,811	3,219	$59,059	126	$1,297	21,277	$333,109
1900	14,075	86,763	133,244	762,493	4,765	58,474	1,968	30,189	[illegible]	4,019	99,169	745,724
1905	131,196	753,004	240,790	1,143,296	34,431	545,354	5,551	89,110	98	1,276	130,149	1,973,588

CLASS IX.—BLEACHING MATERIALS.

The class of bleaching materials comprises chlorine, chloride of lime (chlorinated lime, bleaching powder), chloride of soda (chlorinated soda, solution of chlorinated soda, liquor sodae chloratae, Labarraque's solution, eau de Labarraque), and other hypochlorites, hydrogen dioxide (peroxide), sodium, magnesium, calcium, barium, and other dioxides (peroxides), sulphur dioxide or sulphurous acid, sulphites, and sodium, potassium, calcium, and other bisulphites (hydrogen or acid sulphites).

With the progress of invention in chemical manufacture many of these substances have come to be manufactured by the aid of electricity, and when so made they are grouped under Class X. They are, however, included in the discussion of Class IX when it is sought to ascertain the total quantity and value of the bleaching materials manufactured, the number of establishments engaged in the manufacture, and the geographic distribution of the industry considered as a whole.

Table 72 gives a comparative summary of the bleaching materials industry at the censuses of 1900 and 1905, together with the amount and per cent of increase, those establishments only being considered in which bleaching materials are the principal product, and in which they are made by processes other than by the aid of electricity.

TABLE 72.—*Bleaching materials—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	9	5	[illegible]	80.0
Capital	$221,874	$95,713	$126,161	131.8
Salaried officials, clerks, etc., number	54	10	44	440.0
Salaries	$60,339	$12,734	$47,605	373.8
Wage-earners, average number	66	66	....	....
Total wages	$38,049	$31,893	$6,156	19.3
Miscellaneous expenses	$67,352	$8,388	$58,964	703.0
Cost of materials used	$160,547	$37,096	$123,451	332.8
Value of products	$418,730	$104,801	$313,929	299.5

The statistics of Table 72 show an increase in every item except that of the number of wage-earners for 1905 as compared with 1900, the large gain of $313,929 being reported for value of products. The greatest proportional increase is found in miscellaneous expenses and the smallest in total wages.

Table 73 sets forth the quantity and value of the bleaching materials produced at the censuses of 1900 and 1905, together with the amount and per cent of increase. The figures for bleaching materials manufactured as a subsidiary product are included.

TABLE 73.—*Bleaching materials—quantity and value of products, with amount and per cent of increase: 1905 and 1900.*

KIND.	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Hypochlorites:				
Tons	19,588	10,979	8,609	78.4
Value	$535,835	$462,949	$72,886	15.7
Hydrogen dioxide:				
Pounds	4,370,614	588,335	3,782,279	642.9
Value	$413,221	$63,754	$349,467	548.1
Sulphur dioxide:				
Pounds	[1] 8,725,124	[2] 684,000	8,041,124	1,175.6
Value	[1] $45,983	[2] $9,493	$36,492	384.4
Bisulphites:				
Tons	6,223	1,461	4,762	325.9
Value	$110,155	$34,486	$75,669	219.4
Chlorine, pounds	[3] 15,670,000	8,784,000	6,886,000	78.4
All other products, value	$98,396	$26,643	$52,163	195.8

[1] Includes 8,684,000 pounds, with an assigned value of $45,526, consumed in establishments where manufactured.
[2] Includes 333,415 pounds, with an assigned value of $4,667, consumed in establishments where manufactured.
[3] Consumed in establishments where manufactured.

The statistics of Table 73 show that the largest actual increase at the census of 1905 as compared with that of 1900 was in the quantity of hypochlorites produced, although in percentage of increase this item is the lowest. The greatest percentage of increase in quantity produced was reported for sulphur dioxide, the largest part of which product was, however, consumed in further manufacture in the establishments where produced. In values reported the greatest actual increase as well as the largest percentage of increase was in the production of hydrogen dioxide. It is also to be noted that all of the chlorine reported in the table was produced and consumed.

TABLE 74.—*Bleaching materials—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1]33	[2]26
Illinois		3
Maryland	1	
Massachusetts	4	
Michigan	2	1
Missouri	2	2
New Jersey	3	3
New York	11	10
Ohio	3	1
Pennsylvania	7	6

[1] Includes 24 establishments engaged primarily in the manufacture of other products.
[2] Includes 21 establishments engaged primarily in the manufacture of other products.

The statistics of Table 74 show a net gain of 7 in number of establishments in 1905 as compared with 1900, or 26.9 per cent. Illinois, which reported 3 establishments in 1900, reported none in 1905, while Massachusetts, from which no establishments were returned at the census of 1900, reported 4. New York ranked first in the number of establishments at each census, and Pennsylvania second. Massachusetts, which appears for the first time at this census, held third place. No other state reported more than 3 establishments at either census.

Table 75 shows, for the establishments manufacturing bleaching materials either as a principal or subsidiary product, the quantity and value of the materials used as reported at the censuses of 1900 and 1905, together with the increase and per cent of increase.

TABLE 75.—*Bleaching materials—quantity and cost of principal components used, with amount and per cent of increase: 1905 and 1900.*

KIND.	CENSUS. 1905	CENSUS. 1900	Increase.	Per cent of increase.
Salt:				
Tons	[1]15,713	9,055	6,658	73.5
Cost	[1]$38,141	$19,105	$19,036	99.6
Lime:				
Bushels	[2]358,074	158,561	199,513	125.8
Cost	[2]$30,600	$20,532	$10,068	49.0
Caustic soda:				
Tons	324	168	156	92.9
Cost	$13,175	$7,618	$5,557	72.9
Manganese dioxide:				
Pounds	84,444	93,000	[3]8,556	[3]9.2
Cost	$1,200	$1,325	[3]$125	[3]9.4
Muriatic acid:				
Tons	251	227	24	10.6
Cost	$6,275	$4,325	$1,950	45.1
Soda ash:				
Tons	733	974	[3]241	[3]24.7
Cost	$15,353	$23,368	[3]$8,015	[3]34.3
Potash:				
Tons	11	7	4	57.1
Cost	$1,084	$420	$664	158.1
Sulphur:				
Tons	2,171	171	2,000	1,169.6
Cost	$45,526	$4,000	$41,526	1,038.2
Barium dioxide:				
Tons	218	74	144	194.6
Cost	$53,849	$16,540	$37,309	225.6
Phosphoric acid:				
Pounds	[4]551,206	74,490	476,716	640.0
Cost	[4]$104,286	$14,898	$89,388	600.0
Bleaching powder:				
Tons	55	44	11	25.0
Cost	$1,500	$1,570	[3]$70	[3]4.5
Metallic sodium, pounds	[4]180,000	92,600	87,400	94.4

[1] Includes 13,020 tons of salt from brine or the by-product of other industries having an estimated cost of $29,823.
[2] Includes 9,864 bushels of lime, having an estimated cost of $592, consumed in further manufacture.
[3] Decrease.
[4] Estimated.

From Table 75 it will be seen that there is an increase in every item except in the quantity and value of manganese dioxide, the quantity and value of soda ash, and the value of bleaching powder. The manganese dioxide is used with muriatic acid in making chlorine bleach, such as the chloride of soda from soda ash, and is of minor importance, particularly as electrolytic chlorine is now being produced most abundantly and cheaply, while the product may also be obtained easily from bleaching powder. The decrease in cost of bleaching powder has no significance when the small quantities used are considered.

The greatest increase in quantity is found in phosphoric acid, the next greatest in lime, and the third in salt. The greatest increase in cost is found in phosphoric acid, the next greatest in sulphur, the third in barium dioxide, and the fourth in salt. The greatest percentages of increase are found in the quantity and cost of sulphur and the next greatest in the quantity and cost of phosphoric acid, while barium dioxide rank third.

TABLE 76.—*Bleaching materials—value of products, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1]$1,158,064	[1]$592,658
Illinois		42,399
Massachusetts	41,746	
New Jersey	46,595	39,171
New York	799,521	407,327
Ohio	13,774	(2)
Pennsylvania	37,761	15,878
All other states[3]	218,667	87,883

[1] Includes value of products consumed in establishments where manufactured.
[2] Included in "all other states."
[3] Included in 1905, Maryland, Michigan, and Missouri; in 1900, Michigan, Missouri, and Ohio.

The statistics of Table 76 show that New York ranked first at each census in the value of products. New Jersey passed from the third place in 1900 to the second place in 1905, displacing Illinois, which did not report any production of bleaching materials at the last census. Massachusetts, which appeared in 1905 for the first time, ranked third. The returns for the state of Illinois at the census of 1900 were from establishments in which bleaching materials were packed. At the census of 1905 the reports from such establishments were included under another category.

From the returns it appears that all of the bleaching powder was made from electrolytic chlorine produced from salt. The principal competing process is that in which the salt is first decomposed by the Le Blanc method for producing soda products, forming hydrochloric acid, which is then oxidized to set its chlorine free. Although the latter is the older process and was well and widely established, yet, according to Hasenclever,[1] of the 260,000 tons of bleaching powder, representing the world's production in 1905, one-half was produced electrolytically. The total production of bleaching powder in Germany in 1905

[1] Journal of Society of Chemical Industry, 1907, vol. 25, page 1011.

was 60,000 tons, of which 65 per cent was prepared electrolytically from potassium chloride.

Although, through the discoveries of Knietsch, liquid chlorine has been made an article of commerce and is found extremely useful and convenient in many industries and for laboratory purposes, and although efforts are also being made to find new avenues for the disposal of the chlorine output of this country, yet at no census has there been any return made of liquid chlorine as a product.

The most novel advance in this industry since the census of 1900 is perhaps that found in the development of the dioxides or peroxides and their derivatives. The preparation, properties, and uses of sodium dioxide were set forth to some extent in the report on chemicals and allied products at the census of 1900. Harold J. Turner[1] has devised a very ingenious method for utilizing this material as a source of oxygen.

The action of water on fused sodium peroxide is one of the most convenient and elegant methods for the preparation of oxygen for laboratory or lecture purposes. The liberation of the gas is so lively, however, that a specially constructed generator is usually required to enable one to control the evolution of it. To prepare a small quantity, the most efficient method is the decomposition of the substance by means of water of crystallization. A mixture of equal parts of fused sodium peroxide and crystallized sodium sulphate or carbonate, upon being gently warmed, evolves oxygen in a steady stream, under perfect control of the operator. A 10-gram piece of "oxone" readily evolves, by this process, 4 liters of oxygen. The oxygen is 99 per cent pure, perfectly odorless, tasteless, and colorless. Within the last few months calcium carbide has been decomposed by a like process, known as the Atkins system, with the production of the so-called "sun gas," which is being developed by the Sun Gas Company, of London.

Fused sodium dioxide is now put upon the market under the trade name of oxone. This product has a specific gravity of 2.43; it is hard, but not brittle, and is capable of being cast into any convenient shape; it can be easily transported, without detriment or any mechanical or chemical change, and can be stored and protected from moisture, without any danger or risk of deterioration. Upon contact with water oxone liberates pure oxygen gas, just as calcium carbide in water liberates acetylene gas. The amount of gas thus yielded averages 2.2 cubic feet per pound, or 60 liters reduced to normal pressure and temperature, which corresponds to 322 times the volume of the body. The oxygen evolved is of 99 to 100 per cent purity, the only impurity consisting of a slight vapor caused by the energy of reaction, which is easily absorbed by passing the gas through water, thus furnishing an absolutely pure material. This chemical, furthermore, has the property of absorbing carbon dioxide and moisture, a quality which, combined with its oxidizing capacity, makes it an ideal disinfectant and air purifier. Oxone is sold in the following shapes: In crude form, in 2-pound and 10-pound tins, and in bulk; in cartridges, in boxes of 20, generating 7 to 8 gallons of pure oxygen gas; and in square cakes, 16 in one tin, for calcium lights, averaging 160 liters of oxygen gas.

The use of oxone for the purpose of making confined spaces habitable has been carefully studied by G. F. Brindley and R. von Foregger,[2] who find that one kilogram of oxone would enable a man to live for five hours and twelve minutes in a supply of air sufficient for a single respiration.

Even more novel, possibly, is the manufacture on a commercial scale of other peroxides and their derivatives.

TABLE 77.—*Peroxides now offered in commerce, other than sodium peroxide.*

KIND.	Per cent of peroxide.	Per cent of available oxygen.	Volumes of active oxygen compared with one volume of water.	Method of packing.
Peroxide of calcium	70–85 CaO_2	16–18	120	½-lb. tins and upward.
Peroxide of magnesium	25–32 MgO_2	7–9	60	½-lb. tins and upward.
Peroxide of zinc	50–60 ZnO_2	8–10	70	½-lb. tins and upward.
Peroxide of strontium	90–95 SrO_2	12–12.75	[illegible]	½-lb. tins and upward.
Perborate of sodium	100 $NaBO_3+4\,H_2O$	9–10	70	¼-lb. cartons. 1-lb. cartons. 25 and 50 lb. kegs.
Perborate of zinc		7–8	55	½-lb. tins and upward.
Perborate of magnesium		9–10	70	½-lb. tins and upward.

The peroxides named in Table 77 are active bleaching agents and hence efficient disinfectants. The various compounds, however, differ in solubility in water and hence in the rate at which they evolve ozone. Because of their relative insolubilities and slow rate of reaction, calcium and magnesium peroxides have come to be used to some extent, either alone or in admixture with other substances, for tooth powders, the ozone set free or hydrogen peroxide formed serving to cleanse and purify the teeth.

Table 78 sets forth the imports of chloride of lime, or bleaching powder, for the years 1891 to 1905, as taken from Commerce and Navigation of the United States, published by the Bureau of Statistics.

TABLE 78.—*Chloride of lime, or bleaching powder—imports: 1891 to 1905.*

YEAR ENDING JUNE 30—	Pounds.	Value.
1891	107,475,715	$1,429,509
1892	110,748,289	1,839,640
1893	120,811,918	2,213,121
1894	81,610,463	1,507,076
1895	100,456,774	1,644,835
1896	104,053,877	1,579,358
1897	99,274,138	1,375,560
1898	114,232,578	1,421,920
1899	113,107,250	1,159,271
1900	136,403,151	1,464,019
1901	110,960,523	1,371,028
1902	130,251,696	1,788,354
1903	107,827,117	1,126,666
1904	99,085,386	772,532
1905	96,119,711	776,281

[1] Dry Method for the Generation of Oxygen from Sodium Peroxide. American Chemical Journal, vol. 37, No. 1, January, 1907, page 106.

[2] Report of Experiments with Fused Sodium Peroxide for the Regeneration of Air in Submarines. Ninth General Meeting of the American Electrochemical Society, Ithaca, N. Y., May 1, 2, and 3, 1906.

Class X.—Chemicals Produced by the Aid of Electricity.

This classification appeared for the first time in the special report on chemicals and allied products for the census of 1900. In the comparatively short time that has elapsed since electricity was first practically employed in the manufacture of chemicals, many new and advantageous processes have been found, which have resulted not only in the more economical production of substances already obtained by other methods, but also in the addition of some hitherto unknown to commerce. With the constant progress of discovery and invention in this field it is to be expected that the industry will show an ever widening range in the substances produced, as well as a steady increase in the quantity and value of its products. At the present time these products include, commercially, aluminum, bromine, carbon (in its allotropic form of graphite or plumbago), lead, phosphorus, silicon, and sodium among elementary substances; ferrochrome, ferromanganese, ferrosilicon, and the titanium, tungsten, and vanadium compositions among alloys; and adamite (fused corundum), alundum (artificial corundum), barium hydroxide, calcium carbide, carbon disulphide (bisulphide), carborundum (silicon carbide), caustic soda (sodium hydroxide), hydrochloric acid, litharge and other lead oxides, potassium chlorate (chlorate of potash) potassium hydroxide (caustic potash), siloxicon, and white lead among compound substances.

In this report all establishments producing the above substances, as described, by electricity are included under the present classification. Furthermore, there are establishments in which the direct products of these electrical processes, such as bromine, chlorine, carborundum, hydrogen sulphide, phosphorus, sodium, and the like are partly or wholly consumed on the premises in which they are produced in the further manufacture of potassium bromide, bleaching powder, graphite, sulphuric acid, phosphorus acids, sodium cyanide, sodium and other dioxides, or other substances, and such establishments are also included here, although other establishments which use their original product to produce the same final product, but without the aid of electricity, are classified elsewhere.

Table 79.—*Electro-chemicals—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	20	13	7	53.8
Capital	$11,495,537	$9,170,750	$2,324,787	25.4
Salaried officials, clerks, etc., number	245	88	157	178.4
Salaries	$345,475	$134,033	$211,442	157.8
Wage-earners, average number	2,082	733	1,349	184.0
Total wages	$1,111,850	$374,836	$737,014	196.6
Miscellaneous expenses	$1,457,191	$293,608	$1,163,583	396.3
Cost of materials used	$2,442,596	$900,554	$1,542,042	171.2
Value of products	$7,048,246	$2,036,261	$5,011,985	246.1

The statistics of Table 79 show an increase in every item, the value of products making the substantial gain of $5,011,985, or more than doubling. The greatest proportional increase is presented in miscellaneous expenses, and the next in the value of products. In considering Table 79 it should be noted that the statistics for 1905 include those for the manufacture of aluminum, while in 1900 the returns for this industry were presented under another heading. It must also be pointed out that these figures give but a partial indication of the extent to which electricity is employed in chemical processes of manufacture. The returns from the recovery of gold, silver, copper, iron, and other strictly metallurgical products are included in other categories, while no report at all is made of the oxygen and hydrogen which some establishments manufacture extensively for the purpose of employment in producing high temperatures, or of the bleaches which textile establishments produce for their own use exclusively; and other exceptions could probably be found.

Table 80.—*Electro-chemicals—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1]21	[1]14
Connecticut		1
Maine	1	1
Michigan	4	1
New Hampshire		1
New York	14	10
Virginia	1	
West Virginia	1	

[1] Includes 1 establishment engaged primarily in the manufacture of other products.

New York ranked first at each census in the number of establishments engaged in this industry, reporting two-thirds of the total number returned in 1905. At the census of 1905 Michigan reported 4 establishments. No other state returned more than 1 establishment at either census. This overwhelming supremacy of New York is a consequence of the fact that hitherto the electro-chemical industry has depended primarily for its success on cheap and abundant supplies of water-power, such as are found at Niagara Falls. With the improvements in the efficiency of internal combustion engines, however, through which producer gas, the surplus gas from by-product coke ovens, and the waste gases from blast furnaces may be utilized economically, and with the constant inventions through which other sources of energy in nature may be made use of, it is reasonable to expect a wider distribution of this industry in the future. Indeed it seems possible that other hitherto unused sources of energy may be available at the present time, since it appears by no means impracticable to employ hydrogen sulphide, sulphur vapors, and other combustible gases as the fuel in internal combustion engines and then to utilize their products of combustion in further manufacture.

TABLE 81.—*Electro-chemicals—value of products, by geographic divisions: 1905 and 1900.*

DIVISION.	1905	1900
United States	$7,068,246	$2,045,535
North Atlantic	6,037,533	1,852,279
North Central	827,583	(1)
All other divisions	203,130	193,256

[1] Included in "all other divisions."

Out of the total value of products returned at the census of 1900, New York reported $1,836,606, or 89.8 per cent; while at the census of 1905, out of the total of $7,068,246, that state also reported substantially all shown for the North Atlantic division.

TABLE 82.—*Electro-chemicals—quantity and cost of principal materials used, with amount and per cent of increase: 1905 and 1900.*

KIND.	CENSUS. 1905	CENSUS. 1900	Increase.	Per cent of increase.
Alumina and bauxite:				
Tons	14,164			
Cost	$591,563			
Carbons, cost	$230,744	$32,121	$198,623	618.4
Coal and coke:				
Tons	19,125	11,614	7,511	64.7
Cost	$97,281	$46,229	$51,052	110.4
Lime:				
Bushels	1,309,716	(1)	(1)	(1)
Cost	$133,333	(1)	(1)	(1)
Ores, chrome and iron:				
Tons	3,459			
Cost	$54,539			
Phosphate rock and other minerals:				
Tons	6,189	3,364	2,825	84.0
Cost	$44,437	$24,812	$19,625	79.1
Potassium salts:				
Tons	3,908	1,900	2,008	105.7
Cost	$200,008	$80,097	$119,911	149.7
Salt:				
Tons	13,175	(1)	(1)	(1)
Cost	$30,259	(1)	(1)	(1)
Sodas:				
Tons	1,717	(1)	(1)	(1)
Cost	$72,188	(1)	(1)	(1)
All other materials, cost	$338,522	$247,300	$91,222	36.9

[1] Included in "all other materials."

The statistics of Table 82 show an increase in the case of each substance presented separately at both censuses, the largest increase in quantity being found in coal and coke and the next in phosphate rock. The greatest increase in cost among the materials enumerated is found in carbons and the next in potassium salts. This latter includes muriate of potash and potash salts. The percentages show some exceptionally large increases, but this is a necessary consequence in an industry which came into existence but a short time before the census of 1900 and at the census of 1905 had just attained to a respectable importance. It may cause remark that coal, coke, and charcoal, which are usually used as fuels, appear as materials used, but as a fact carbon, in one of these various forms, enters as one of the components into the production of calcium carbide, carbon disulphide, carbon tetrachloride, carborundum, and other carbon compounds.

As already indicated, Niagara Falls, N. Y., is to-day the chief seat of the electro-chemical industry and it has held this rank since the industry was introduced into this country. On the occasion of the holding of the International Electrical Congress in September, 1904, a guide[1] for visitors from abroad attending the congress and visiting Niagara Falls was prepared under the auspices of the American Institute of Electrical Engineers, from which it appears that in 1904 there were two companies, the Niagara Falls Hydraulic Power and Manufacturing Company and the Niagara Falls Power Company, both situated on the American side of the Niagara river, engaged in transforming the energy of the water into electricity, while three companies were then engaged in developing plants on the Canadian side for the purpose. The Niagara Falls Hydraulic Power and Manufacturing Company established its first station for supplying electricity for commercial purposes in 1881, and it was here that the public distribution of electricity from Niagara Falls began. In 1904 current was being supplied from its power house to the Pittsburg Reduction Company for use in the isolation of aluminum; to the National Electrolytic Company for the manufacture of chlorate of potash; and to the Acker Process Company for the manufacture of caustic soda, bleaching powder, tetrachloride of tin (known to the trade as bichloride of tin), oxide of tin, tin crystals, and carbon tetrachloride. The Niagara Falls Power Company supplied current to the Pittsburg Reduction Company; to the Carborundum Company for the manufacture of silicon carbide and silicon; to the Union Carbide Company for the manufacture of calcium carbide; to the Electrical Lead Reduction Company for the manufacture of spongy lead, litharge, red lead, and white lead; to the International Acheson Graphite Company for the manufacture of graphite, graphite paint, and graphitized electrodes; to the Roberts Chemical Company for the manufacture of caustic potash and hydrochloric acid; to the Norton Emery Wheel Company for the manufacture of alundum; and to the Niagara Research Laboratories, where new electro-chemical processes are tested on a large scale and with a view to their commercial form until factory conditions are determined.

There appear to have been other establishments making electro-chemical products at Niagara Falls that are not enumerated in the publication just mentioned. Taking into account all the establishments, it is reported that the average consumption of electric energy in the electro-chemical industries of Niagara Falls was, at the census of 1900, 15,161 kilowatts and, at the census of 1905, 37,910 kilowatts. The peak load figures were naturally higher than this, being about 50 per cent greater at the census of 1900 and about 23 per cent greater at that of 1905. It is reasonable to expect, as the manufacture of electro-chemicals increases in magnitude and operating methods are perfected, that the percentage of difference between the average and the peak load will be a diminishing quantity.

[1] The Niagara Falls Electrical Handbook.

Table 83, taken from The Mineral Industry,[1] sets forth the quantity and value of the aluminum produced, imported, exported, and consumed in the United States from 1897 to 1906.

[1] The Mineral Industry, vol. 15, page 11.

TABLE 83.—ALUMINUM—PRODUCTION, IMPORTS, EXPORTS, AND CONSUMPTION: 1897 TO 1906.

YEAR.	PRODUCTION.			IMPORTS.			Exports (value).	Consumption (value).
				Crude.		Manufactures (value).		
	Pounds.	Value.	Per pound.	Pounds.	Value.			
1906	14,350,000	$5,166,000	$0.36	770,713	$154,292	$1,866	$364,251	$4,957,907
1905	11,350,000	3,632,000	0.32	530,429	106,108	33	290,777	3,015,364
1904	7,700,000	2,233,000	0.29	515,416	128,350	478	166,876	2,494,952
1903	7,500,000	2,325,000	0.31	498,655	139,298	4,273	157,187	2,311,384
1902	7,300,000	2,284,590	0.31	745,217	215,032	3,819	116,052	2,387,389
1901	7,150,000	2,238,000	0.31	564,803	104,168	5,580	183,579	2,164,169
1900	7,150,000	2,288,000	0.32	256,559	44,455	5,989	281,821	2,056,623
1899	6,500,000	2,112,500	0.33	53,622	9,425	7,828	291,515	1,838,238
1898	5,200,000	1,690,000	0.33	60	30	13,840	238,997	1,474,268
1897	4,000,000	1,400,000	0.35	1,822	1,082	3,647	(1)	1,404,729

[1] Not reported.

Continuing, The Mineral Industry says:

Aluminum is now a strong competitor with copper and other metals, and doubtless the increase in the price of copper has been instrumental, on this account, in the rise in price of aluminum which occurred during 1906. However, the fact that the demand is far in excess of production is the chief reason for the present high price of aluminum. The amount of aluminum consumed is limited only by the number of furnaces which are now in operation, and by the capacity of the dynamos which operate the furnaces.

The Pittsburg Reduction Company (now the Aluminum Company of America) was the only producer. It owns large bauxite deposits in Georgia, Alabama, and Arkansas, obtaining, however, most of its ore from Saline county in the latter state. It has done a large amount of stripping and development work at its mines at Bauxite, Ark., also is just completing there a new crushing, grinding, and drying plant, and has built a railroad called the Bauxite and Northern, connecting all of its mines in that region with the Chicago, Rock Island and Pacific Railroad and the Missouri Pacific and Iron Mountain systems. This company has realized that reserve stores of bauxite are as essential to the welfare of a large aluminum company as reserves of iron ore are to a great steel corporation, and it has accordingly spent large sums of money in purchasing bauxite lands both in the eastern district—Georgia and Alabama—and in Arkansas.

Concerning the production of pure alumina, this company has enlarged to great dimensions its chemical plant at East St. Louis. The process used is the same as heretofore, but the capacity of the plant has been increased several times. The power for the plant is furnished by condensing turbine engines; the evaporating plant is the most complete and largest of its kind ever built.

The carbons used in the reduction are now manufactured entirely by this company, being baked in electrically heated furnaces patented by Charles M. Hall. The old plant for making carbons, at the upper Niagara works, has been practically torn down and rebuilt to three times its previous capacity; the buildings are of steel, with traveling cranes and every up-to-date conveying appliance; the new plant has an equipment and capacity equal to that of any other carbon electrode plant in the world.

The rolling and sheet mills of the company have been correspondingly enlarged; a new mill for this purpose is in course of construction at Niagara Falls. This is of reinforced concrete, and when finished will be one of the largest and most complete sheet rolling mills in America.

The work thus done by this company within the last three years, in plants and processes entirely outside of the reduction of the metal, has been on a scale which, remembering the former infancy of the aluminum industry, may be properly characterized as stupendous. The investments thus made in these accessory enterprises have amounted to several millions of dollars.

The reduction plants of this company, at Niagara Falls, Massena, N. Y., and Shawenegan Falls, Quebec, Canada, are all in process of being greatly enlarged. At Niagara Falls, the lower plant, using power supplied from the canal of the Niagara Falls Power and Manufacturing Company, which has heretofore been reported as of 12,000 horsepower capacity, has been increased by the building of a very large plant to use 45,000 horsepower, consisting of five units of 9,000 horsepower each. Two of these units (18,000 horsepower) will be in operation by May, 1907, and the whole plant in June, 1907. At Shawenegan Falls, the company is quadrupling its already large capacity and expects the new plant to be finished ready for operation in April, 1907. This plant is nominally controlled by the Northern Aluminum Company, which is a subsidiary company of the American company, and manufactures aluminum chiefly for export; it is expected that this increased capacity will exceed the demands for export, but the company is intent upon providing reserve facilities equal to all possible demands of the near future. At Massena, the company has purchased the entire plant of the St. Lawrence River Power Company, with its canal and power house of 40,000 horsepower capacity, and is actively preparing to dredge out the canal to double this capacity. One of the largest of modern dipper dredges and the most powerful elevator dredge ever built have been installed ready to commence operations as soon as the winter is over. The complete dredging plant has cost over a million dollars. A new power house for this enlarged capacity will be started in 1907, and eight large water wheels, to absorb the capacity of the first canal, have been purchased and will be placed in position in the old power house within a few months. The output of this plant in 1907 will be from two to three times the output of 1906.

Bradley's United States Patent No. 168148, covering the production of aluminum from a molten electrolyte by the action of the internally generated electrical heat of the decomposing current and without the aid of external heat, was confirmed by the United States circuit court of appeals, and this patent holds until February, 1909. Hall's original patent, covering the electrolysis of a melted bath of double fluoride of aluminum and a more positive metal, as a solvent for alumina, expired on April 2, 1906, and as such is now the property of the public, but it must be operated by externally applied heat.

Aluminum [1] is largely supplanting phosphide of copper as a deoxidizer in brass and bronze, in which it acts by reducing the oxides of copper, zinc, or tin with which the metal may be contaminated. A small excess of aluminum does not injure the metal so much as a small excess of phosphorus. Care must be taken, however, not to cast the alloy immediately after using the deoxidizer, since the alumina formed must be given an opportunity to rise out of the metal and enter the slag. If this is not done, the quality of the metal may be injured by the intermingled alumina. With pure copper used for electrical purposes, silicon is found superior as a deoxidizer to aluminum, because the silica formed is less infusible, tends to unite with copper oxide to a fusible slag, and thus gets out of the melted metal quicker and more completely, leaving it with higher electric conductivity.

Dr. Hans Goldschmidt, the inventor of the process of reducing metallic oxides by powdered aluminum, has recently patented improvements in his method of obtaining fluid iron at high temperature for welding purposes. In place of aluminum as the sole reducing agent acting upon iron oxide, producing the difficultly fusible alumina, he uses a granulated alloy of calcium and aluminum, or a mixture of these two metals in granular form. This alloy gives a very high thermal effect, higher even than aluminum alone, while the heat of formation of the aluminate of lime slag is also utilized, and the slag is much more fusible than alumina alone.

According to The Mineral Industry, volume 15, page 28—

The manufacture of alundum was begun by the Norton Emery Wheel Company, of Worcester, Mass., in 1904. It is an artificial product formed in the electric furnace from bauxite, and is used as an abrasive. Its chemical composition is exactly the same as that of natural corundum. The production of alundum has been as follows: In 1904, 4,020,000 pounds, valued at $281,400; in 1905, 3,612,000 pounds, valued at $252,840; in 1906, 4,331,233 pounds, valued at $303,186.

Before the invention of the electric furnace, artificial abrasives suitable for grinding purposes were unknown, and manufacturers necessarily depended upon natural products, chiefly corundum, emery, and garnet. Briefly, the process of making alundum consists in taking the mineral bauxite (oxide of aluminum), purifying it and melting in an electric furnace into a large homogeneous mass. Upon cooling, this molten fluid solidifies and crystallizes in solid masses of alundum of great purity and uniformity.

The bauxite is heated in large preliminary furnaces to drive off its combined water and is then melted directly in electric furnaces of special design. There are 11 electric furnaces installed at the company's plant at Niagara Falls, N. Y., each furnace being capable of producing three tons of alundum per twenty-four hours. The temperature at which the bauxite melts into a homogeneous mass is estimated at between 6,000 and 7,000 degrees Fahrenheit.

After the large masses of molten bauxite have cooled in the furnace, the fusion is broken up by crushers and passed through rolls to reduce the product to various sizes of grain, which are finally graded by passing through sieves of different mesh in preparation for manufacture into grinding wheels and blocks, polishing stones, etc.

Alundum is much harder than the correspondingly natural product, corundum, represented by the sapphire or ruby, and alundum powder is used for cutting and drilling rubies and sapphires for watch jewels, but its chief use is in the manufacture of "artificial emery" grinding wheels, as they are called.

Many new applications of carborundum have recently been made in the arts, but notwithstanding its varied uses in the mechanical, chemical, and metallurgical fields its application as an abrasive is still of chief importance and consumes the major part of the production.

[1] The Mineral Industry, vol. 15, page 23.

In this field a development of great interest is the application of carborundum to the marble industry. The methods of cutting, dressing, and polishing marble are now in a process of rapid and complete revolution owing to the use of carborundum wheels. A complete line of machinery has been developed for the various operations of coping, countersinking, molding, rubbing, and polishing, which largely dispenses with the old style machine tools and also with skilled labor. The molding machine equipped with carborundum wheels is capable of removing stock at the rate of 60 cubic inches per minute. The carborundum drum rubber displaces five of the old style rubbing beds.

The methods of beveling plate glass have undergone radical changes and one operator is now able to bevel 6,500 feet per day, using in this time 10 pounds of carborundum grains. The use of carborundum has long been general throughout the granite industry and its introduction in the marble and glass industries naturally follows and promises equally important economies.

Carborundum paper is now being introduced in the woodworking trades, where it displaces garnet paper, and into the hat trade, in competition with fine flint paper for pouncing and finishing hats. The paper industry now utilizes carborundum in the form of blocks for the construction of bedplates in the beaters and for the lining of Jordan engines. It assists in refining the pulp.

Carborundum applied to nonslipping stair treads, carriage treads, and to nonslipping horseshoes has been made the subject of several recent patents. This branch of the trade consumes an important amount of product. Carborundum is being introduced for the same purpose in the construction of cement pavements and sidewalks.

Amorphous carborundum, or as it is commercially called, carborundum fire-sand, is now widely used as a refractory material, and the methods of using it in the form of bricks and various furnace linings have been the subject of a large number of patents both in this country and abroad. This product occurs in the carborundum furnace immediately outside the crystalline zone and contains carbon, silicon, and oxygen in the form of various compounds representing the partial reduction of silica by carbon. It is used in lining crucible furnaces for melting brass and also in the later designs of tilting brass furnaces, especially in those burning crude oil fuel. It resists severe flame action as do few refractory materials available to the furnaceman. The material is ground to the fineness of about No. 20 mesh and is mixed according to the following formula: Carborundum fire-sand, 70 parts; fire clay, 15 parts; silicate of soda, 52° B., 8 parts; water, 7 parts. This mixture is tamped in place and slowly dried. When subjected to furnace temperatures it burns into a strong refractory body. Amorphous carborundum is one of the few refractories which can withstand the heat of the powdered coal flame. Fire bricks made from carborundum are now on the market and have given favorable results in the arches of copper reverberatory furnaces and also in boiler furnaces where special smoke consuming devices are used. The use of both crystalline and amorphous carborundum for the manufacture of zinc retorts is increasing, especially among foreign smelters, and many hundreds of tons were exported for this purpose during 1906. The best results are obtained by making the inner lining of the retort of carborundum and the exterior of fire clay. W. A. McAdam (British patent No. 16168, July 17, 1906) uses powdered carborundum in molds for the casting of aluminum and obtains a rapid chilling of the metal, which increases its tensile strength.

Carborundum has found important use as a resistance material, especially in the manufacture of resistance rods for lightning arresters. In one method of manufacture the rods are made up from a mixture of plastic clay, powdered carborundum, graphite, etc., and are fired in a potter's kiln. The rods are then glazed throughout their length to prevent the absorption of moisture and the ends are electroplated or otherwise treated to provide good electrical contact to the terminals. These rods are generally made in small sizes, from 6 to 10 inches long, and are used to protect circuits of comparatively low voltage. For high potential lines rods made of No. 40 to 60 carborundum grains with a vitrified porcelain binder

are giving satisfactory service for potentials of 60,000 volts. These rods are 6 feet in length and 3 inches in diameter. When measuring the electrical resistance of the rods no readings can be obtained with the ordinary Wheatstone bridge. When, however, they are subjected to a potential of 10,000 volts current readings are obtained which indicate a resistance of from 120,000 to 150,000 ohms. Siemens Brothers, of Charlottenburg, in a recent patent propose to make electric resistance rods and anodes for electrolytic baths from a mixture of silicon carbide and silicon. Another inventor makes resistance rods for heaters, rheostats, and the like, using carborundum with a vulcanized rubber bond.

A carborundum wireless detector was developed in 1906 by Gen. H. H. C. Dunwoody of the American DeForest Wireless Telegraph Company and is being used in a large number of the company's installations. The device consists of a minute fragment of carborundum held in place between two metallic terminals or conductor plugs of copper or brass.

As a result of several years' research work, Prof. H. C. Parker and W. G. Clark brought out in 1906 the Helion lamp. The filament of this lamp is formed by subjecting a heated carbon filament to vapors of silicon, whereby there is produced a conductive compound of silicon and carbon, which doubtless coincides chemically with the silicon carbide. The Helion lamp is claimed to have remarkable life and efficiency, surpassing in this respect the new tantalum and tungsten lamps.

The calcium carbide industry has been given a marked impetus by the invention of the Frank and Caro process for the manufacture of calcium cyanamid from calcium carbide and atmospheric nitrogen, which has already been felt abroad and which will probably be shown statistically in the report of the next census. According to The Mineral Industry[1] the production of calcium carbide in the United States is now controlled by the Union Carbide Company, operating at Niagara Falls and at Sault Ste. Marie, as the only other producer is operating on a small scale and is involved in litigation.

The utilization of electrolytic chlorine in the manufacture of carbon tetrachloride has so cheapened the cost of this very useful article that since 1900 it has passed from the category of rarely occurring chemicals found in laboratories to that of the commonly occurring bodies applied to common uses.

Carbon tetrachloride is a heavy, colorless, transparent liquid with an agreeable and aromatic odor. Its specific gravity is 1.604 and one gallon weighs 13.3 pounds. It is noninflammable, noncombustible, and nonexplosive, and its vapor extinguishes flame. Its boiling point is 77° C. It can be evaporated off completely without residue. It is insoluble in water, in alcohol containing less than 75 per cent by volume of absolute alcohol, and in glycerin. It is freely soluble in acetone, glacial acetic acid, oleic acid, ethyl and amyl alcohol, chloroform, carbon disulphide, benzole, benzine, ether, aniline oil, spirits of turpentine, petroleum and all petroleum oils, and fixed and volatile oils.

Carbon tetrachloride is one of the greatest of solvents. It dissolves oils, fats, resins, wax, gutta-percha, ceresin, spermaceti, paraffin, stearin, varnish, asphaltum, pitch, balsams, coal tar, pine tar, rubber, salicylic acid, carbolic acid, iodine, bromine, iodoform, bromoform, menthol, thymol, camphor, naphthalene, sulphur chloride, soda and potash, soaps, ammonia, and numerous other chemicals and products. It is not acted upon by either strong acids or alkali. As an extracting medium, it has found wide application in the extraction of fats and oils from oil seeds, oil cake, animal tankage, wool, wool and cotton waste, and other oil and fat bearing materials. They are extracted pure, absolutely free from residual solvent and contaminating odor, taste, or "chemical smell," and the extracted materials may be produced absolutely free from solvent and with no odor or taste imparted to them.

Oil cake extracted with carbon tetrachloride is a feeding stuff of excellent quality, better than unextracted cake, in which the high oil content is worthless and generally considered objectionable. It is very much better than cake extracted with other solvents, which, because of the residual solvent, usually is of poor taste, and has an objectionable physiological action on cattle, so that material extracted with such other solvents has to be used for purposes which command a much lower price.

Its remarkable solvent properties make it an extremely valuable constituent in rubber and gutta-percha cements and in the rubber and gutta-percha industries, likewise in the lacquer, varnish, and paint remover industries, and for innumerable other purposes of similar nature.

A carbon tetrachloride solution of sulphur chloride is a vulcanizing agent of great value.

It is a very excellent cleansing agent, as it does not affect in the least the most delicate fabrics, including silk, satin, wool, cotton, lace, feathers, etc., and the most delicate shades of color are not injured in the slightest degree when carbon tetrachloride is properly applied. It is therefore of peculiar value for dry cleaning and cleansing establishments, which have heretofore used naphtha and benzine.

Aside from its advantage as a solvent it has the additional advantage of being fireproof, noninflammable, and nonexplosive, and therefore eliminates the extreme fire insurance premiums which are charged when benzine, benzole, naphtha, and similar solvents are used. In a suitable apparatus the loss of carbon tetrachloride is very minute, so that many important economies in operation are permitted, and the products produced by its use command higher selling prices as well as open and larger markets. Garments cleaned with tetrachloride of carbon do not have an offensive smell, as they may have when cleaned with benzine, naphtha, or gasoline. Carbon tetrachloride can be mixed with turpentine, naphtha, gasoline, benzine, benzole, etc., so as to render these products noninflammable and nonexplosive at an ordinary temperature, and is therefore of decided importance to those who are obliged to use considerable quantities of the solvents named.

[1] The Mineral Industry, vol. 15, page 89.

Carbon tetrachloride is packed in steel drums holding approximately 215 pounds, 650 pounds, and 1,350 pounds, and also in 10-gallon, 5-gallon, 2-gallon, and 1-gallon cans, weighing approximately 140 pounds, 68 pounds, 27 pounds, and 14 pounds, respectively.

A recent development of scientific interest is the use of the electric furnace in the process of melting quartz or rock crystal, which is a pure form of silica occurring in nature, for it becomes possible by this means to produce, for use in chemistry and physics, vessels which endure high temperatures without melting, great variations in temperature without cracking, and the corrosive action of the larger number of concentrated acids.

According to Dr. L. H. Baekeland,[1] a marked improvement has been effected in the manufacture of alkaline hydroxides and chlorine by the electrolysis of alkali chlorides through the use of the cell invented by Clinton P. Townsend. This has been worked on a commercial scale at the Niagara plant of the Development and Funding Company, which has an average daily capacity of 5 tons of caustic soda and 11 tons of high-grade bleach, and the results have been so encouraging that the plant is about to be increased to fourfold this capacity. The form of the cell is such that the anode space contains saturated brine while the cathode compartment contains kerosene oil. On account of the difference in specific gravity between the two liquids there is a hydrostatic pressure from the anode compartment toward the cathode compartment. Even if the level of the two liquids be the same, there is a tendency on the part of the brine in the anode compartment to press through the diaphragm and flow into the kerosene. If the electric current be turned on, the percolating brine becomes cathode liquid and carries caustic hydrate. The strength in caustic will increase according to the number of amperes which are sent through the cell. Furthermore, each drop of liquid as soon as it traverses the diaphragm runs through the perforations of the anode plate and acquires a globular shape, by a capillary phenomenon, produced on contact with the kerosene oil. This provokes a rapid separation of the aqueous liquid, so that every drop as soon as it forms detaches itself rapidly, sinks to the bottom of the oil, and accumulates in a small caustic pocket. This puts it entirely outside of the zone of possible chemical or physical action. A goose-neck tube drains this liquid from the supernatant oil, and thereby avoids its accumulation in quantities more than desired. The inflow and outflow of the brine at the anode compartment are so regulated as to maintain a steady level. By a simple contrivance this level can be increased or decreased at will, thus controlling the hydrostatic pressure on the inside of the anode compartment. This gives a simple means of increasing the rate of percolation, and thereby producing stronger or weaker caustic liquor, in accordance with the density of the electric current.

The first diaphragms used in the Townsend cell were made of asbestos paper, but this necessitated delicate handling, and the expense for renewals was considerable. During the last fourteen months the whole plant has been operated with diaphragms after Baekeland's patent. These latter consist of a woven sheet of asbestos cloth, the pores of which are filled with a special mixture of oxide of iron, asbestos fiber, and colloid iron hydroxide. The latter material produces a sort of binder for the asbestos fiber and the oxide of iron; its function is somewhat similar to that of rosin or glue size in the manufacture of asbestos paper, but it has a great advantage over organic sizes, in that it does not become gummy in contact with sodium hydrate. The mixture is applied with a brush and painted on as ordinary paint. Whenever a diaphragm has to be renovated the surface is simply scrubbed and washed with water; a new coat of paint is applied, and after this is dry the diaphragm is again ready for use. This process has only to be repeated at long intervals, and requires but a few minutes. A diaphragm may not require repainting for several months. Even when impure or unsettled brine is used the painting has to be done only about once in five weeks.

If the cells are run with proper care, the Acheson graphite anodes used last an astonishingly long time. In some experiments where cells were operated with especial attention, corrosion was so slight that delicate scratches which had been made with the point of a needle on the surface of the anodes showed very distinctly and with no alteration after several months of continuous operation. Even under the worst conditions the anodes only require partial renewal after one year of continuous hard service.

The strength of the caustic liquor produced in the Townsend cell can be regulated at will by increasing or decreasing percolation in conjunction with the strength of the current. By reducing percolation, cathode liquor containing 250 grams of NaOH per liter or more can be produced. In practice it is found advantageous to produce liquor containing about 150 grams of NaOH per liter. Such liquor carries also about 213 grams of salt. The latter is separated by evaporation from the caustic lye and is used over again.

Among notable suggestions relative to the utilization of sodium is the proposition to use it as a substitute for copper in electric conductors, since sodium has the greatest conductivity per unit of weight of any of the common metals. Mr. Anson G. Betts[2] constructed such a conductor in January, 1906, by filling lengths of 1½-inch wrought iron pipe with molten sodium and, when the sodium was solidified, screwing the lengths together to form a line. For the same conductivity the price of the complete sodium conductor

[1] "The New Electrolytic Alkali Works at Niagara Falls"—Electro-Chemical and Metallurgical Industry, 1907, vol. 5, page 209.

[2] Electrical World, 1906, vol. 48, page 914.

is much below that of copper cables,[1] being in small sizes not more than 50 per cent and in large sizes not more than 20 per cent of the cost of copper. For instance, a half-inch wrought iron pipe filled with sodium has a capacity of 109 amperes, and costs about 3½ cents per foot, against 8½ cents for a copper line of the same capacity. A 6-inch sodium conductor would carry 8,130 amperes, the cost of the line being about $1.40 per linear foot, as compared with $6.30 per linear foot for copper. These figures were estimated on the basis of 7½ cents per pound for sodium and 16 cents per pound for copper.

Another product of electro-chemical establishments, which consumes surplus chlorine, is sulphur chloride, which is a yellowish red, oily liquid, having a specific gravity of 1.709, and mixes in all proportions with carbon tetrachloride, benzol, carbon disulphide, etc., also with petroleum or naphtha. It is used in the cold or dip process of vulcanizing rubber; in the preparation of rubber substitutes, artificial drying oils, linseed oil substitutes from menhaden, and fish oils, corn oils, etc., and for the thickening of oils, rapid manufacture of printers' ink, and other manufacturing and special purposes. It is sold in lead-lined steel drums holding about 675 pounds and 1,300 pounds, respectively, in 5-gallon boxed jugs, and in 1-pound and 5-pound bottles.

Other developments worthy of special note in this industry are found in the electric smelting of iron ore for the production of iron and steel, there being in 1906 five electric smelting furnaces for this purpose in the United States and Canada, furnaces of the induction type of Colby, Kjellin, and Heroult being used; in the manufacture of phosphorus, since the nodules of wavellite found with iron and manganese ores, in the clay deposits near Carlisle, Pa., are mixed with apatite and used as a source of phosphorus; in the manufacture of graphite, since Acheson has been able to produce a form which remains suspended indefinitely in lubricating oil, thus forming an ideal lubricant; and in the manufacture of barium hydroxide and silicide, for which considerable commercial uses are being found.

Table 84.—*Plumbago—imports entered for consumption: 1891 to 1905.*

YEAR ENDING JUNE 30—	Tons.	Value.
1891	10,135	$509,809
1892	13,511	726,648
1893	14,207	866,309
1894	7,935	410,819
1895	7,051	208,935
1896	11,891	384,554
1897	12,459	321,355
1898	11,154	472,401
1899	15,970	1,081,859
1900	20,597	2,345,294
1901	13,077	929,986
1902	16,081	963,356
1903	18,354	1,247,584
1904	13,302	991,134
1905	13,676	915,306

[1] Daily Consular and Trade Reports, 1907, No. 2797, page 14.

Table 84 sets forth the imports of plumbago for the years 1891 to 1905, inclusive, as taken from Commerce and Navigation of the United States, published by the Bureau of Statistics.

Class XI.—Dyestuffs.

The class of dyestuffs comprises natural dyestuffs, including logwood, fustic, quercitron, cochineal, lac dye, kermes, gambier, Persian berries, curcuma, Brazil wood, madder, cutch, and yellow oak bark, the ground and chipped wood, bark, or berries of these natural dyestuffs, and extracts such as logwood extract; artificial dyestuffs, such as the aniline, phenol, azo, quinoline and anthracene colors, synthetic indigo, the so-called coal tar dyes, special compositions or mixtures of dyes, and mineral dyes used in printing, such as chrome yellow, orange and green, iron buff or nankin yellow, prussian blue, ultramarine, and manganese brown; mordants such as myrobalans, valonia, divi-divi, chestnut, nutgalls, oak and hemlock bark, the ground product and the extracts of these materials, special mordanting liquids containing inorganic compounds, and assistants such as turkey red oil, iron liquor (black liquor, pyrolignite of iron), red liquor (aluminum sulpho-acetate), gums, dextrins, and sizes.

Table 85.—*Dyestuffs—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	51	44	7	15.9
Capital	$7,507,837	$6,279,877	$1,227,960	19.6
Salaried officials, clerks, etc., number	193	165	28	17.0
Salaries	$348,318	$236,084	$112,234	47.5
Wage-earners, average number	816	1,093	[1]277	[1]25.3
Total wages	$476,041	$580,605	[1]$104,564	[1]18.0
Miscellaneous expenses	$426,327	$379,238	$47,089	12.4
Cost of materials used	$3,471,236	$3,725,149	[1]$253,913	[1]6.8
Value of products	$5,277,523	$5,637,464	[1]$359,941	[1]6.4

[1] Decrease.

The statistics of Table 85 show an increase in the number of establishments and of salaried employees, and in the amount of capital, salaries, and miscellaneous expenses for 1905 as compared with 1900, but they show a decrease in every other item, the largest decrease appearing in the value of products and the next largest in the cost of materials used; while the largest decrease in per cent appears in the average number of wage-earners and the second largest in the total wages paid. As the dyeing and printing industries have prospered and should therefore consume more rather than less dyestuffs at the later census, it would appear that, following the course of industrial development so strongly emphasized in this census, the dye and print works have manufactured a large part of the dyestuffs which they have consumed in the manufacture of their finished products, in place of purchasing them from other manufacturers as formerly.

TABLE 86.—*Dyestuffs—quantity and value of products: 1905 and 1900.*

KIND.	1905		1900	
	Pounds.	Value.	Pounds.	Value.
Total	72,421,670	$5,666,416	60,729,671	$6,523,618
Artificial dyestuffs	10,640,910	2,665,134	7,698,435	2,280,899
Ground and chipped wood	9,033,867	83,166	(1)	(1)
Gum and dextrin	6,366,351	223,326	(1)	(1)
Iron liquor	2,120,968	45,316	3,344,568	32,065
Mordants	5,154,330	246,432	734,000	85,466
Natural dyestuffs	31,755,886	1,766,273	48,245,628	3,435,808
Red liquor	(1)	(1)	707,040	7,340
Sizes	7,349,358	223,326		
All other dyestuffs		413,443		682,040

[1] Not reported separately.

The statistics of Table 86 show an increase in the total quantity but a decrease in the total value of the products for 1905 as compared with 1900. The separate items of the table show an increase in every item which appears at both censuses except in the quantity and value of natural dyestuffs, the quantity of iron liquor, and the value of all other dyestuffs. It is believed that much of the dextrin is manufactured as a subsidiary product in another industry which does not report it separately, and therefore it is not given separately in Table 86.

TABLE 87.—*Dyestuffs—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1] 61	[2] 60
Connecticut	2	2
Florida		1
Illinois	2	2
Maine	3	1
Maryland	1	
Massachusetts	15	15
New Jersey	12	8
New York	8	20
North Carolina	1	
Pennsylvania	6	7
Rhode Island	8	2
South Carolina	1	2
Vermont		1
West Virginia	1	1
Wisconsin	1	

[1] Includes 10 establishments engaged primarily in the manufacture of other products.
[2] Includes 16 establishments engaged primarily in the manufacture of other products.

Table 87 shows that the total number of establishments has increased by but 1, and that there have been some marked changes in the different states, New York decreasing 12 in number, while Rhode Island has gained 6, New Jersey 4, and Maine 2. Massachusetts ranks first at the census of 1905, New Jersey second, New York and Rhode Island third. It is interesting to note that this industry is practically confined to the states of the North Atlantic division.

The statistics of Table 88 show a decrease for 1905 as compared with 1900 in the total value of the product and in the value of the product of every state except New Jersey, for which comparative statistics are set forth. New Jersey, which ranked fourth at the census of 1900, ranks first at that of 1905. The statistics for Rhode Island and Maine are presented separately for the first time at the present census.

TABLE 88.—*Dyestuffs—value of products, by states: 1905 and 1900.*

STATE.	1905	1900
United States	$5,666,416	$6,523,618
Maine	30,051	(1)
Massachusetts	863,496	1,377,822
New Jersey	1,925,473	899,468
New York	1,611,244	2,098,402
Pennsylvania	489,167	906,564
Rhode Island	513,006	(1)
All other states [2]	233,979	1,241,362

[1] Included in "all other states."
[2] Includes in 1905, Connecticut, Illinois, Maryland, North Carolina, South Carolina, Vermont, West Virginia, and Wisconsin; in 1900, Connecticut, Florida, Illinois, Maine, Rhode Island, Vermont, and West Virginia.

The statistics of Table 89 show a decrease in each item for natural dyestuffs set forth at both censuses, but an increase in each item for artificial dyestuffs. Sulphuric acid has decreased in quantity and increased slightly in value, while other acids have decreased in quantity and increased greatly in value, facts which indicate a greater consumption of the higher priced acids. Chemicals have increased in value, and salt in both quantity and value.

TABLE 89.—*Dyestuffs—quantity and cost of principal materials used: 1905 and 1900.*

KIND.	1905	1900
Logwood:		
Tons	45,556	51,955
Cost	$793,865	$1,084,746
Cutch:		
Pounds	85,786	798,508
Cost	$6,366	$61,697
Fustic:		
Tons		3,204
Cost		$51,585
Logwood extract:		
Pounds	264,394	2,364,792
Cost	$21,785	$163,408
Fustic extract:		
Pounds	5,099,880	
Cost	$37,529	
Aniline colors:		
Pounds	1,321,567	1,734,717
Cost	$636,617	$849,229
Other coal tar products:		
Pounds	13,950,842	1,417,325
Cost	$751,905	$333,317
Indigo:		
Pounds	96,500	109,034
Cost	$82,000	$125,069
Acids:		
Sulphuric—		
Pounds	1,173,989	1,222,357
Cost	$18,992	$18,750
Other acids—		
Pounds	2,995,946	4,135,328
Cost	$81,029	$54,298
Starch:		
Pounds	6,815,442	(1)
Cost	$173,103	(1)
Caustic soda:		
Tons	154	(1)
Cost	$8,366	(1)
Soda ash:		
Tons	1,885	(1)
Cost	$60,521	(1)
Sulphur:		
Tons	1,190	(1)
Cost	$24,699	(1)
Oils:		
Gallons	110,608	(1)
Cost	$38,265	(1)
Fats:		
Pounds	830,783	(1)
Cost	$46,642	(1)
Chemicals:		
Pounds	1,003,669	
Cost	$30,110	$14,510
Salt:		
Tons	2,935	1,078
Cost	$9,790	$5,298
Alum:		
Pounds	(1)	291,400
Cost	(1)	$9,065

[1] Not shown separately.

The dyestuffs and tanning extracts industries are so closely associated that combined statistics have been

compiled for them since the census of 1880 under the caption "dyestuffs and extracts." These statistics are set forth in Table 90 for each census from 1880 to 1905.

TABLE 90.—*Dyestuffs and extracts—comparison of statistics: 1880 to 1905.*

CENSUS.	Number of establishments.	Capital.	Number of wage-earners.	Value of products.
1905	98	$14,904,150	2,707	$10,893,113
1900	77	7,839,034	1,647	7,350,748
1890	62	8,645,458	2,111	9,292,514
1880	41	2,363,700	[1] 992	5,253,038

[1] Includes salaried employees.

The statistics of Table 90 show a constant increase in every item at each succeeding census except in the amount of capital, number of wage-earners, and value of products at the census of 1900, which show a decrease as compared with these items at the census of 1890. It is to be noted that the capital invested has increased to a greater extent than the value of the products, for while the former has increased from 1880 to 1905 to the amount of $12,540,450, or 530.5 per cent, the latter has increased but $5,640,075, or 107.4 per cent.

It has been said[1] that—

Almost the first industries established in the American colonies, after they were settled, and after they had taken measures to establish a food supply, were spinning and weaving, and dyeing came soon after. New dyestuffs were found here, and permanent dyehouses were established sooner than woolen factories. Butternut was a very common dye, but logwood and other substances prevented it from being used in any other than the most common work. Indigo, cochineal, annotto, quercitron, and Brazil wood were among those introduced from abroad shortly afterwards, and have stayed in use up to the present time. Mordants afterwards became known, and later mineral dyes. Within the lifetime of the present generation a new and exceedingly brilliant series of colors for dyeing has been evolved from coal tar. The industry of dyeing is now very widely spread. Nearly every mill devoted to textiles has a dyehouse, and there are many independent works throughout the country.

The year 1906 marked the fiftieth anniversary of the epoch making discovery by William Henry Perkin of the dyestuff "mauve," by which the foundation of the coal tar color industry was laid and a great stimulus was given to the study of organic chemistry. This anniversary was celebrated on an extensive scale throughout the civilized world, and honors, titles, and dignities were conferred on the discoverer.

The discovery, which was destined to have such far-reaching consequences, was made in the Easter vacation of 1856, while Perkin, then only a lad of 18 was working in a private laboratory he had fitted up in his father's house. The coloring matter was patented on the 26th of August of the same year, and in the early part of the following year the erection of the first coal tar color works was commenced at Greenford Green, near Harrow, England. Here mauve was soon produced in quantity and here also were manufactured later other coal tar dyestuffs, including artificial alizarin. From these small beginnings the industry has now grown to dimensions which neither the discoverer nor any man of his time could have foreseen. Not only has an enormous and highly scientific industry been established, which with its collateral branches has an output with an estimated value of upward of $100,000,000 per annum, but the dyeing and related industries have been subjected to a complete revolution by which empiric methods have been changed to scientific ones. Side by side with this technical progress and closely interrelated with it is the immense stimulus which the establishment and rapid growth of the coal tar industry have given to the study of pure organic chemistry, especially that of ring carbon compounds. The development of this industry has also exerted a large influence upon the entire chemical trade of the world, and directly given birth to several derivative industries, such as the manufacture of synthetic medicinal agents, antiseptics, synthetic perfumes, artificial sweetening materials, and explosives.

It is a curious fact to note that although French manufacturers promptly recognized the importance of Perkin's discovery and were, in fact, the first to put mauve colored calicos upon the English market, the manufacture of coal tar dyestuffs has passed almost wholly into the control of the manufacturers of Germany where it gives employment to thousands of workmen. It was stated at the Perkin Jubilee that there were at that time 700 distinct color dyestuffs produced from coal tar.

The first mention of the coal tar dyestuff manufacture in the United States was at the census of 1880, when 3 establishments were reported as producing 80,518 pounds of aniline dyestuffs, valued at $107,292.

At the census of 1905, 10,640,910 pounds of artificial dyestuffs, valued at $2,665,154, were reported as produced. Since these dyestuffs included products obtained by mixing purchased coal tar dyes to give desired shades or effects, products obtained by mixing extracts with coal tar dyes to form special compositions, and compositions formed from vegetable extracts and mineral substances, and since the total annual production of artificial dyestuffs throughout the world is in the neighborhood of $100,000,000, it is evident that the quantity and value of the dyestuffs produced from coal tar derivates or distillates in the United States is still relatively insignificant.

Schultz and Julius[2] in their Tabular Presentation of Artificial Organic Dyestuffs found in Commerce, published in 1902, give a list of 63 firms operating 88 establishments, then engaged in the manufacture of coal tar dyestuffs. Thirty-one of these establishments were in Germany, 19 in France, 13 in England,

[1] C. M. Depew, One Hundred Years of American Commerce, 1895, page 671.

[2] Gustave Schultz and Paul Julius, Tabellarische übersicht der im Handel befindlichen küntslichen Organischen Farbstoffe, Berlin. 1902.

6 in Russia, 6 in the United States, 6 in Switzerland, 3 in Holland, 2 in Belgium, and 2 in Italy. In this book 681 different dyestuffs are described which the authors found were prepared for sale and use. Two hundred and forty-five of these were granted the protection of patents in the United States. Out of these 681 different substances, only 20 are mentioned as being manufactured in the United States and of these 20, but 3 were protected by patents, so that we may say that the manufacture of artificial organic dyestuffs in this country is confined largely to those whose manufacture is open to all.

While there is no criticism to be made on Schultz and Julius' estimate, it would appear that the number of colors made in this country is larger now than in 1902, for in a circular received from one manufacturing establishment in 1906 there are enumerated 97 different colors: 49 acid colors, 33 basic colors, and 15 direct colors, divided among water soluble, alcohol soluble, and oil soluble colors, and in some instances there are as many as six grades of a given color.

Inspection of Table 91 shows that coal tar colors or dyes not specially provided for to the value of $5,635,-164 were imported into the United States in 1905. This value is larger than the value of any other item shown in the table and is more than twice the value of all the artificial dyestuffs reported as manufactured in the United States at the census of 1905.

As stated above, this industry is controlled by Germany. Considering the foreign trade alone of that country the value of the chemicals exported from Germany[1] in 1905 was $131,395,500, of which the artificial dyestuffs, valued at $48,665,000, constituted nearly 40 per cent. Among these were included aniline dyes, valued at $24,065,500, and alizarin and indigo, valued at $9,733,000. The extent of the development of this industry in Germany is further emphasized by the statement[1] that of the 31 aniline color works in Germany, the bulk of the trade is in the hands of 5 firms, forming two large combinations. The combined nominal capital of these 5 firms is nearly $24,332,500, and the net annual profits $9,733,000, 60 per cent of which is paid in dividends and the remainder of which is carried to depreciation. The average dividend of these aniline dye works has exceeded 20 per cent for many years, while the dividend paid by individual firms has in some cases exceeded 30 per cent. The Badische Anilin und Soda Fabrick began business in 1895 with 40 men; in 1905 it employed 7,251. Many of the reasons that have been advanced for the acquisition of the control of this industry by Germany are set forth in the prefatory remarks to the special report on chemicals and allied products at the census of 1900, and others will be found in revision of the Tariff Hearings before the Committee on Ways and Means, Fifty-first Congress, 1st session, 1890, pages 391 to 398, and Fifty-third Congress, 1st session, 1893, pages 22 to 26.

These remarks are strongly stated in a History of the Development of the Coal Tar Industry in the United States, prepared by Mr. J. F. Schoellkopf for presentation to Congress when the Wilson Tariff bill was under consideration. He has kindly permitted its use here, and as it has not been published heretofore and as there is much in it which is worthy of consideration in this connection, it is given below.

To properly understand the causes of the slow development of this industry in the United States, it will be advisable to give a short sketch of its inception and progress in Europe up to the present time.

Though Perkin began the manufacture of coal tar dyes in England in 1857, they were first produced on a considerable commercial scale in France, and at a later date their manufacture was taken up in Switzerland and Germany. But while the growth of this new branch of industry was not extraordinary in the first-named countries, the history of it in Germany reads like a fairy tale. One can truthfully say that Germany's greatness and present supremacy in the chemical arts dates from the time it actively engaged in the production of coal tar dyes. From practically nothing in 1862, the value of the output of the German factories had risen to $6,000,000 in 1874, to $10,000,000 in 1878, $12,500,000 in 1882, and to fully $17,000,-000 in 1890. This is in the face of the fact that the goods were not only vastly improved in quality, but also very materially cheapened in price; magenta for instance falling in this time from $300 per pound to 90 cents, and aniline blue from $800 per pound to $1.

Germany has a capital of at least $20,000,000 invested in the industry which gives employment to fully 15,000 hands directly and to at least as many more indirectly. The amount of chemicals and other material consumed by this industry is simply stupendous, one factory alone using 160,000 tons of coal annually. The main reason for this wonderful growth in Germany was probably the judicious cooperation of theory and practice, the working together of factory and university, which in no other country was carried out to the extent it was in Germany. During this period of rapid development, it is obvious, there could be no surplus of scientific or expert manual help to start factories of a similar nature in America. The chemists graduated from German universities who had chosen this branch of chemistry as their specialty immediately found remunerative employment in one of the home factories. No one thought of leaving the "Fatherland," and seeking his fortune elsewhere.

These conditions, however, changed radically about the year 1880. The universities and chemical schools had continued to grind out coal tar chemists in increasing numbers, until the home factories were no longer able to take care of all of them, and naturally they looked around for other fields of operation. At this time the United States apparently presented an inviting field. The consumption of colors was already large and constantly increasing. The import duty at that time was 35 per cent ad valorem and 50 cents per pound specific, which, taking into consideration the low price the dyes had reached, was ample protection. There were as yet no colors produced in this country, if one excepts the magenta turned out by the now extinct Albany Aniline Color Works. They produced a small quantity of poor magenta in a very crude way and had been doing this ten years back, without attempting to enlarge by adding new colors to their product. As stated above, America presented an inviting field and during the years 1880 to 1883 no fewer than 9 different plants for the manufacture of coal tar dyes were established. The prospect of becoming independent of other nations for our supply of these important colors was bright indeed until the passage of the tariff act of July 1, 1883. This act abolished the specific duty of 50 cents per pound, leaving an ad valorem duty of 35 per cent on coal tar colors, or dyes, and 20 per cent on coal tar preparations not

[1] J. T. Conroy, "The Chemical Trade of England and Germany," Journal, Society Chemical Industry, 1906, vol. 25, page 1011.

colors, or dyes. This left a net protection for the colors of nominally 15 per cent, but it will appear later that even this meager protection was completely neutralized through various circumstances.

The evil effects of this adverse tariff legislation showed itself almost immediately. No new factories were started and within one year after the new tariff took effect, 5 of those already established were forced to succumb and go out of business. The remaining 4 would have gladly followed their examples, but they had invested large sums of money in plant (the Buffalo factory having expended about $500,000 in this way), which would not have brought 10 cents on the dollar if sold. So they decided to continue to operate their factories, hoping for more favorable legislation in the future. But thus far they have always been bitterly disappointed in this. At every tariff revision this industry, which, if properly fostered, would be of such enormous importance to the chemical industry at large, has been treated in a most unfair and unkind manner. The parties interested have repeatedly asked for an increase of duty, which has as often been refused. They have asked for a decrease of duty on raw material, which has also been refused. As their raw materials are not made in this country, and never will be under existing conditions, it is not comprehensible why this latter request has not been granted. They finally petitioned Congress to change the phraseology of the paragraphs referring to coal tar colors and alizarin red, to prevent fraud and misunderstandings at the custom-house. But even this just request, which was recommended by the appraisers department in New York, was not acceded to.

It can be safely predicted that unless the policy of Congress toward this industry shows a decided change for the better very soon, it will soon entirely disappear in America. It is a well-known fact, that since 1883 the European factories, especially those in Germany, have been distributing ever increasing dividends, the earnings of the larger concerns for the past few years having amounted to over 50 per cent on their enormous capital invested. During all this time the industry in America has languished. The factories have been barely able to hold their own and as to making any profits or even interest on the capital invested, that was out of the question entirely.

The principal causes of the nondevelopment of the industry in America, under existing conditions, are as follows: First, high wages; second, greater first cost of plant and larger annual cost of wear and tear; third, higher cost of coal tar preparations and other chemicals and materials; fourth, high tax on alcohol for industrial purposes. Each of these causes will be discussed separately, and as to their correctness, each reader can judge for himself after perusing the following. All the statements made and the figures given are the results of actual experience and positive knowledge and are vouched for as absolutely correct.

First—High wages.—It must be taken into consideration that in works of this kind, besides the regular labor engaged in the production of colors, a number of mechanics are permanently employed such as engineers, machinists, carpenters, masons, pipe fitters, etc. This class of help is necessary to renew and keep the plant in repair and to carry out the frequent changes made necessary by improvements or changes in the processes. This class of labor forms quite an important item in the weekly pay roll. Its remuneration is from $2 to $3 per day of ten hours, while the same men in German factories receive but 75 cents per day of eleven hours. Ordinary labor in America costs $1.50 per day of ten hours, while the German manufacturers pay only 60 cents per day of eleven hours for similar help. To more clearly illustrate the advantage the foreign employer possesses over his American competitor in this respect, we give under "Exhibit A" the labor cost of an American coal tar dye factory, with a capacity valued at $25,000 per month, as compared with a factory of the same kind and size in Germany. From this exhibit it appears that to produce $25,000 worth of colors the American is obliged to pay directly for labor $4,110, while his German rival has the same work performed for but $1,798.20.

Second—Greater first cost of plant and larger annual cost of maintenance.—In America a plant designed for an output valued at $25,000 per month will cost:

For land and building	$100,000
For machinery, tools, etc	180,000
For working capital	200,000
Total	480,000

In Germany the same plant would cost at the outside:

For land and building	$75,000
For machinery, tools, etc	100,000
For working capital	140,000
Total	315,000

This shows a higher first cost for the American factory of $165,000, which at 6 per cent per annum amounts to an extra yearly charge of $9,900. If we allow 5 per cent for depreciation on buildings and 10 per cent for "wear and tear" on machinery, etc., we find that these items amount to $1,916.67 per month in America and to only $1,145.83 per month in Germany. See "Exhibit B."

Third—Higher cost of coal tar preparations and other chemicals and materials.—"Exhibit D" shows the kinds and quantities of raw materials used for producing $25,000 worth of coal tar dyes. It also shows their cost in Germany and in America under the present law, and under the proposed Wilson bill. This is the class of raw materials now principally used by the American manufacturers. "Exhibit C" shows prices of these products per 100 pounds in Germany, and in America under the present law, and under the proposed Wilson bill. From "Exhibit D" it appears that the materials used cost 22 per cent more here than in Germany under the present tariff and under the proposed Wilson bill would still cost 19.75 per cent more. Now as the Wilson bill places coal tar preparations on the free list, the small benefit shown requires some explanation. By referring to "Exhibit D" it will be observed that the coal tar preparations, aniline oil and aniline salt, which constitute 60 per cent in value of the materials used, are on the free list to-day and are therefore not cheapened by the Wilson bill. In fact, the only materials cheapened to any extent are the soda products and naphthol.

Fourth—High tax on alcohol for industrial purposes.—In America alcohol for industrial purposes costs about $2.25 per gallon. In Germany alcohol for industrial purposes costs only about 35 cents per gallon. It is obvious, therefore, that coal tar colors, requiring in their preparations the use of alcohol, can not be profitably made in the United States.

"Exhibit E" shows the total cost of producing and marketing $25,000 worth of coal tar dyes: First, when made in the United States under the McKinley tariff; second, when made in the United States under the proposed Wilson bill; third, when made in Germany and imported, including a duty of 35 per cent ad valorem. It is clearly shown that the German-made goods can be imported, and after paying a duty of 35 per cent, can be sold as low as the American-made colors. It is obvious, therefore, that if the duty on coal tar dyes is reduced below the present rate of 35 per cent, the American manufacturers will be quickly driven out of business. In preparing the Wilson bill the fact was not taken into consideration that the colors now being manufactured in America are made from free coal tar preparations, and that those paying a duty of 20 per cent can not be used. It was evidently taken for granted that coal tar preparations constituted the item of chief value in the make-up of coal tar dyes. We have shown, however, that they constitute only about one-third of the value of the finished product. The Wilson bill, by putting *all* coal tar preparations on the free list, will permit the use of a large number of products for the manufacture of a new line of dyes, but *only* if the duty of 35 per cent on colors is retained.

We repeat: The Wilson bill as it now stands means the extinction of every coal tar dye factory in the United States, even if the 20 per cent duty is honestly paid. But there is a paragraph in the free list, which in a short time will admit every important coal tar color absolutely free of duty. The paragraph referred to is No. 366 in section 2: "Alizarin, natural or artificial, and all colors or dyes, *commercially* known as alizarin colors, or dyes." Under this provision every color or dye of any importance will be rebap-

tized and become *commercially* known as alizarin color, or dye. Why any product should be admitted under its commercial name is incomprehensible and requires an explanation. This is a vicious attack on the American color industry, and if allowed to stand must be followed by disastrous results, no matter how high the duty on colors may *nominally* be.

If it be desirable to retain and develop the coal tar dye industry in America, the present duty of 35 per cent must not be disturbed. All coal tar preparations, not colors, or dyes, should be made free, and the words "and all colors, or dyes, commercially known as alizarin colors or dyes" should be stricken out of paragraph 366 of the Wilson bill.

Exhibit A.—*Table showing employees needed for a coal tar dye factory having a capacity valued at $25,000 per month.*

EMPLOYEES.	MONTHLY WAGES IN—	
	United States.	Germany.
Total wages per month	$4,110.00	$1,798.20
4 chemists	700.00	400.00
2 clerks	200.00	100.00
60 men	2,250.00	900.00
5 foremen	250.00	150.00
1 mason	75.00	19.50
2 carpenters	130.00	39.00
1 engineer	75.00	35.00
2 pipe fitters	120.00	39.00
1 blacksmith	45.00	19.50
2 night watchmen	110.00	39.00
2 teamsters	90.00	31.20
5 boys	65.00	26.00

Exhibit B.—*Table showing cost of coal tar plant designed for a monthly output valued at $25,000, also showing the monthly cost of depreciation of buildings and wear and tear of the machinery, etc.*

	COST OF PLANT IN—	
	United States.	Germany.
Total cost of plant	$480,000.00	$315,000.00
For land and buildings	100,000.00	75,000.00
For machinery, tools, etc	180,000.00	100,000.00
For working capital	200,000.00	140,000.00
Total monthly cost for depreciation and wear and tear	1,916.67	1,145.83
Depreciation per month on land and buildings at rate of 5 per cent per annum	416.67	312.50
Wear and tear per month on machinery at rate of 10 per cent per annum	1,500.00	833.33

Exhibit C.—*Table showing principal raw materials used in American color factories, giving prices for same here and in Germany.*

MATERIAL.	PRICE PER 100 POUNDS IN CENTS IN—		
	America.		Germany.
	Under McKinley tariff.	Under proposed Wilson bill.	
Sulphuric acid	85.0	85.0	38.0
Muriatic acid	100.0	100.0	25.0
Nitric acid	450.0	450.0	350.0
Common salt	17.5	17.5	12.5
Lime	33.0	33.0	25.0
Ice	10.0	10.0	10.0
Iron borings	60.0	60.0	45.0
Caustic soda	350.0	300.0	225.0
Soda ash	180.0	168.0	130.0
Nitrate soda	725.0	725.0	540.0
Zinc	450.0	395.0	300.0
Benzole	700.0	700.0	700.0
Aniline oil	1,350.0	1,350.0	1,250.0
Aniline salt	1,250.0	1,250.0	1,200.0
Beta naphthol	1,230.0	1,038.0	961.0
Benzoic acid	4,100.0	4,100.0	4,000.0

Exhibit D.—*Table showing the quantity and cost of raw materials used for the production of $25,000 worth of coal tar dyes.*

MATERIAL.	Pounds used.	COST IN—		
		America.		Germany.
		Under McKinley tariff.	Under proposed Wilson bill.	
Sulphuric acid	155,590	$1,237.51	$1,237.51	$553.25
Muriatic acid	47,730	477.30	477.30	119.33
Nitric acid	12,450	560.24	560.24	435.76
Common salt	150,000	262.50	262.50	188.50
Lime	5,280	17.60	17.60	13.20
Ice	27,000	27.00	27.00	27.00
Iron borings	450	2.70	2.70	2.01
Caustic soda	11,550	404.24	346.50	259.87
Soda ash	5,520	99.36	92.74	71.76
Nitrate soda	9,780	709.04	709.04	528.12
Zinc	6,000	270.00	237.00	180.00
Benzole	10,830	758.10	758.10	758.10
Aniline oil	61,200	8,262.00	8,262.00	7,650.00
Aniline salt	5,400	675.00	675.00	648.00
Beta naphthol	10,020	1,232.46	1,040.08	842.92
Benzoic acid	30	12.00	12.00	11.70
Total	518,830	15,007.05 122%	14,717.31 119.75%	12,289 52 100%

Exhibit E.—*Table showing total cost of producing $25,000 worth of coal tar dyes in America as compared with equal quantity produced abroad and imported.*

	COST WHEN MADE IN UNITED STATES—		Cost when made in Germany and imported.
	Under McKinley tariff.	Under proposed Wilson bill.	
Raw materials (see "Exhibit D")	$15,007.05	$14,717.31	$12,289.52
Depreciation and wear and tear (see "Exhibit B")	1,916.67	1,916.67	1,145.83
Expense for steam for power and heating	1,000.00	1,000.00	1,000.00
Incidentals	500.00	500.00	400.00
Labor (see "Exhibit A")	4,110.00	4,110.00	1,798.20
Total cost	22,533.72	22,243.98	16,633.55
Duty, 35 per cent ad valorem			5,820.34
Selling expense 10 per cent	2,500.00	2,500.00	2,500.00
Aggregate cost	25,033.72	24,743.98	24,953.89

Among the innovations in this industry that have come into special prominence since the census of 1900, although they originated much earlier, are the sulphur dyes. According to Matthews[1]—

The original representative of these colors was discovered a number of years ago, in 1873, by Croissant and Bretonniére, and it was given the name of "cachou de Laval." It was prepared in rather a peculiar manner by the fusion of organic vegetable matter, such as sawdust, etc., with sodium sulphide and sulphur. The resulting product was a porous, lumpy mass of a brownish black color and readily soluble in water, and decomposing in moist air with the liberation of some sulphuretted hydrogen. It was found that unmordanted cotton could be dyed by this substance a brown color, though the dyestuff, it is true, had but slight tinctorial properties compared with the other artificial dyes, yet the color obtained with it was very fast to washing. It was on account of its fastness that the new coloring matter received a considerable amount of attention. The general method of applying the dyestuff was to boil the cotton material in a solution containing the coloring matter together with a rather large proportion of common salt. This was for the purpose of forcing on the fiber more color, as otherwise it took a very large proportion of the dyestuff to produce any depth of color. Even under these conditions, however, the dyestuff does not exhaust from the first bath to any great degree. By after-treating the dyed color with a solution of potassium bichromate, the intensity of the color is somewhat enhanced and the general fastness of the

[1] Journal of the Franklin Institute, 1905, vol. 109.

dyestuff is improved. By a similar after-treatment of the color with bluestone or copper sulphate, the fastness of the dyeing to light appears to be somewhat increased.

It was also found that cachou de Laval when dyed on cotton acted as a mordant toward a large number of other coloring matters, such as most of the common basic dyes, the vegetable dyewoods, and the alizarin dyes. The shades obtained with the basic dyes, however, are not as fast to washing as the original cachou de Laval, also those with the vegetable dyewoods are not so fast to light; but the shades obtained in conjunction with the alizarin dyes are as a rule fast to both washing and light.

Owing to the small tinctorial powers of cachou de Laval, it never became of much commercial importance in dyeing. It was looked upon chiefly as a curiosity among the artificial dyestuffs, particularly on account of its peculiar method of manufacture.

A number of years passed before the sulphur dyes received any further development. It was not until about 1893 that the French chemist Vidal publicly announced his discovery of a black sulphur dyestuff which he called 'Vidal black.' This coloring matter was made by fusing para-amido-phenol with sulphur. The product obtained was of uncertain composition, but was found to yield black colors on unmordanted cotton, and was especially characterized by its great fastness. The dyestuff, however, was liable to decomposition on exposure to the air, and presented certain practical difficulties in dyeing so that at first it was not received with much favor. A number of years passed in the development and perfection of this coloring matter and a study of its properties and possibilities, until it had passed beyond the stage of experiment and finally attained commercial success. This led the attention of other dyestuff chemists, especially those of the large German color factories, to the investigation of the sulphur dyestuffs, with the result that great activity was soon displayed in the preparation of new colors, and the purification and modification of those already known. A large number of these dyes have appeared in trade during the past five or six years, and the range of colors has been so extended as to include various shades of black, brown, blue, green, olive, yellow, and orange colors; a red color among the sulphur dyes is still lacking, the nearest approach being the so-called orange, and certain very red shades of brown. All of these colors are applied in about the same manner and are only used on cotton, giving shades which are very fast, especially to washing and acids, and on this account are very desirable products.

The sulphur colors usually appear in trade in the form of blackish lumps, which are hygroscopic and rapidly deteriorate on exposure to the air, especially in the presence of moisture. On this account the dyestuff should be used up as soon as possible after the package is opened. Recently, however, some of these dyes have appeared in the form of dry powders and are not so hygroscopic, being mixed with some suitable dryer, and consequently are not so liable to deteriorate. The manufacturers also seem to be preparing these dyes in a much purer and more concentrated form so that their tinctorial power is considerably increased. The sulphur dyes nearly all smell more or less of sulphuretted hydrogen, especially when moistened or dissolved in water; they also, as a rule, contain more or less sodium sulphide.

Some of the sulphur dyes may be dyed directly on cotton with nothing but the solution of the coloring matter; in other cases, however, a considerable amount of sodium sulphide must be added to the dye bath for the purpose of bringing the dyestuff into proper solution; there is also added some soda ash for the purpose of correcting any hardness which may be present in the water and which would cause a precipitation of the coloring matter. In general, these dyes are applied in about the same manner, as regards the manipulation of the cotton materials, as when other dyes are employed. Care must be taken, however, in most cases, not to have any copper or brass fitting present in the dyeing vats, as the dyestuff is decomposed by these metals; iron and lead, however, may be used without danger. Some of the dyes require an after-treatment with certain metallic salts, especially potassium bichromate or copper sulphate, in order to yield the full development and fastness of the color. In their general fastness they far surpass the other colors available for cotton dyeing, and are comparable in fastness to indigo and aniline black. They are especially suited to the dyeing of material contained in cotton and woolen fabrics, where the cotton is dyed first and the wool is afterwards dyed in acid baths, as these colors will stand the treatment with hot acid baths. The dyestuff does not cause any injury to the cotton fiber, though the dyed goods should be carefully washed in order to eliminate all excess of sodium sulphide, the retention of which by the fiber would eventually cause a weakening; but beyond this the dyestuff itself does not weaken the goods. One drawback to these colors, however, is that in dyeing them the cotton is liable to become somewhat harsh to the feel, although the fiber may be softened by suitable treatment with oil or soap baths. The sulphur blacks are especially adapted for the dyeing of fast blacks of hosiery, as also are the brown colors, as the dyestuffs stand the repeated washings and the effect of the acid preparation to which the color of hosiery is subjected.

It is interesting to note the consumption of the products of the dyestuff industry at the different censuses. Fortunately this may be done with the aid of the following tabular statement from Bulletin 74 of the census of 1905,[1] which shows the cost of chemicals and dyestuffs used in all textile establishments (exclusive of shoddy and felt hat mills) and independent dyeing and finishing works in 1890, 1900, and 1905.

Cost of chemicals and dyestuffs used in all textile establishments: 1890 to 1905.

	1905	1900	1890
Total	$26,682,619	$25,392,573	$19,686,663
Independent dyeing and finishing establishments	10,587,319	10,667,621	8,407,693
Other textile establishments	16,095,300	14,724,952	11,278,970
Cotton manufactures [1]	4,573,375	5,718,107	4,266,773
Wool manufactures [2]	9,177,681	7,983,684	5,889,612
Hosiery and knit goods	1,677,252	1,023,161	564,053
Silk manufactures	666,992	(3)	558,532

[1] Includes cotton goods and cotton small wares.
[2] Includes worsted goods; woolen goods; carpets and rugs, other than rag; felt goods, and wool hats.
[3] Not reported separately in 1900.

Rather more than one-half, in value, of all the materials reported as consumed in 1905 by independent establishments consisted of chemicals and dyestuffs. Inasmuch as the value of such articles shows a positive decline since 1900, although the work done by these establishments, being of the same character and presumably divided as to the amount of each particular process in fairly similar proportions, has largely increased, it seems a reasonable inference that the average price of those materials decreased but that the quantities used increased.

Table 91 sets forth the imports of dyestuffs for consumption during the years ending June 30, 1891 to 1905, as taken from Commerce and Navigation of the United States, published by the Bureau of Statistics.

[1] Page 206.

TABLE 91.—DYESTUFFS—IMPORTS ENTERED FOR CONSUMPTION: 1891 TO 1905.

YEAR ENDING JUNE 30—	LOGWOOD.		EXTRACTS AND DECOCTIONS OF LOGWOOD AND OTHER DYEWOODS.		CAMWOOD.		FUSTIC.		ALL OTHER DYEWOODS.		CUDBEAR.	
	Tons.	Value.	Pounds.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Pounds.	Value.
1891	84,381	$1,842,954	3,282,227	$275,802	3	$220	9,100	$132,841	1,002	$28,969	402,241	$37,889
1892	60,297	1,233,592	4,227,017	325,576	29	3,339	8,490	125,067	2,527	50,131	276,690	24,597
1893	56,404	1,218,934	3,757,259	287,723	26	3,745	10,293	165,807	479	8,978	320,348	25,317
1894	53,709	1,313,376	2,817,451	196,397	70	5,770	7,765	126,309	347	4,426	151,121	12,666
1895	60,683	1,478,618	3,565,277	261,762	23	1,676	6,299	89,696	553	12,386	148,024	13,129
1896	66,074	1,522,069	4,910,176	287,120	50	3,748	6,832	90,389	1,155	18,583	118,517	9,256
1897	33,462	611,010	5,459,302	277,798	....	....	7,918	102,472	639	8,327	66,804	4,902
1898	46,977	744,135	3,664,623	232,986	....	....	9,923	137,666	2,726	33,475	66,795	4,795
1899	37,518	547,334	3,113,558	207,406	....	....	9,198	121,665	8,834	103,276	36,487	2,919
1900	48,190	628,464	3,420,276	227,527	1	161	4,440	60,886	20,967	205,351	61,305	3,944
1901	54,480	857,991	2,864,875	191,852	....	....	7,140	83,695	14,985	151,849	44,332	2,964
1902	53,625	774,796	3,221,606	219,208	....	....	4,353	59,562	11,128	101,188	60,909	3,779
1903	51,008	748,550	3,480,032	237,362	....	....	8,516	114,569	28,560	290,473	50,117	2,945
1904	48,491	663,572	3,121,218	269,228	....	....	4,618	51,011	28,799	313,262	55,250	3,558
1905	36,167	459,824	3,686,730	323,763	1	131	4,371	59,909	849	17,700	66,088	3,785

YEAR ENDING JUNE 30—	GAMBIER, OR TERRA JAPONICA.		CRUDE INDIGO.		INDIGO CARMINE.		EXTRACTS OR PASTES OF INDIGO.		Substitute indigo (value).	MADDER OR MUNJEET, OR INDIAN MADDER, GROUND OR PREPARED.		Orchil or orchil liquid (value).	Safflower and extract of saffron and saffron cake (value).
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.		Pounds.	Value.		
1891	27,610,594	$1,343,604	2,089,500	$1,600,865	28,175	$33,145	881,969	$58,288	$416	673,260	$39,806	$81,974	$44,598
1892	25,808,495	1,069,043	2,460,635	1,772,506	23,600	28,636	826,887	58,845	....	518,786	52,063	68,779	55,391
1893	35,762,646	1,305,468	3,226,314	3,137,511	29,687	35,304	1,317,835	101,347	2,793	653,779	61,720	64,928	27,697
1894	26,408,458	981,328	1,717,635	1,218,580	12,504	16,907	829,380	68,474	1,587	262,563	17,576	43,235	24,341
1895	29,022,603	963,255	3,411,539	1,940,250	26,173	33,405	605,750	57,317	187	329,477	18,541	59,317	16,462
1896	32,343,256	1,108,611	2,707,928	1,571,018	34,967	42,369	590,664	55,361	....	318,313	15,746	62,831	33,765
1897	31,349,555	959,501	3,010,005	1,586,309	52,192	59,182	469,729	51,153	....	292,462	12,963	38,965	38,022
1898	42,333,486	1,021,288	3,058,787	1,807,336	25,671	26,642	396,760	59,001	....	246,218	11,816	56,755	52,482
1899	38,123,478	754,497	3,127,182	1,698,583	17,505	17,172	254,531	23,324	....	280,081	12,298	45,494	32,477
1900	38,857,515	906,282	2,747,043	1,446,490	18,204	15,767	251,538	20,094	....	120,736	5,869	47,134	44,502
1901	26,811,197	824,444	3,139,063	1,402,894	11,061	9,789	181,168	12,292	....	178,872	11,329	31,937	42,502
1902	28,508,836	1,165,081	2,957,673	1,035,980	15,555	13,401	145,024	9,022	....	118,316	6,615	44,847	35,005
1903	42,719,254	2,042,036	4,532,021	1,202,342	22,206	17,190	168,484	12,912	....	153,171	9,706	63,438	43,554
1904	28,387,698	1,274,048	5,046,612	1,282,497	18,731	13,775	132,247	9,522	....	146,382	9,073	56,028	43,145
1905	32,192,891	1,112,660	4,830,955	873,781	24,304	18,529	126,070	8,649	....	58,218	3,841	44,205	60,132

YEAR ENDING JUNE 30—	COCHINEAL.		OIL OF ANILINE.		Salts of aniline (value).	ALIZARIN, NATURAL OR ARTIFICIAL, AND DYES COMMERCIALLY KNOWN AS ALIZARIN YELLOW, ORANGE, GREEN, BLUE, BROWN, AND BLACK, INCLUDING EXTRACT OF MADDER.		Coal tar colors or dyes, not specially provided for (value).	ALIZARIN ASSISTANT OR SOLUBLE OIL, OR OLEATE OF SODA, OR TURKEY RED OIL.		ALIZARIN ASSISTANT, ETC., ALL OTHER.		DEXTRIN, BURNT STARCH, GUM SUBSTITUTE, OR BRITISH GUM.	
	Pounds.	Value.	Pounds.	Value.		Pounds.	Value.		Gallons.	Value.	Pounds.	Value.	Pounds.	Value.
1891	86,797	$19,935	1,489,908	$299,662	$713,732	3,443,167	$674,101	$1,632,642	653	$437	1,325	$717	6,319,352	$212,968
1892	230,039	55,883	1,428,070	253,248	536,477	4,838,220	1,029,122	1,640,024	....	....	3,997	2,262	3,275,326	137,408
1893	215,512	52,572	1,211,818	163,539	432,134	5,729,221	1,125,506	2,322,258	....	....	2,901	1,157	4,650,215	161,430
1894	104,284	28,124	951,671	115,141	395,575	3,960,079	722,919	1,429,101	....	....	1,153	577	3,988,361	121,963
1895	130,205	37,285	1,315,934	143,426	548,110	5,287,720	870,383	2,739,933	92,158	25,735	....	....	....	....
1896	160,422	50,988	1,364,674	164,238	662,459	6,154,156	994,395	2,918,332	82,376	24,626	....	....	....	....
1897	137,261	41,943	....	....	812,884	6,169,018	1,023,425	3,163,182	....	....	....	....	4,874,656	124,719
1898	158,055	45,762	....	....	1,087,704	5,871,962	886,349	3,723,388	....	....	....	....	3,737,575	108,919
1899	97,563	23,207	....	....	743,130	5,226,452	700,786	3,900,099	....	....	....	....	3,402,474	99,056
1900	158,911	31,408	....	....	537,812	6,009,552	771,336	4,792,103	....	....	....	....	5,950,487	169,470
1901	114,414	20,414	1,530,950	143,268	589,535	4,046,986	713,392	4,034,171	....	....	....	....	5,692,395	164,120
1902	138,821	24,865	1,928,920	177,415	631,467	6,550,083	1,028,327	4,911,668	....	....	....	....	6,544,470	160,607
1903	112,714	24,215	1,899,933	167,976	789,553	4,307,428	660,464	5,252,611	....	....	....	....	6,532,764	149,637
1904	162,362	64,246	2,238,840	200,569	686,184	4,666,007	636,418	4,903,077	....	....	....	....	4,784,981	131,289
1905	84,332	36,876	2,362,480	209,385	712,925	4,076,573	625,076	5,635,164	....	....	....	....	4,000,102	128,779

CLASS XII.—TANNING MATERIALS.

The class of tanning materials includes the ground, chipped, and comminuted products of oak, chestnut, chestnut oak and hemlock wood or bark, palmetto roots, sumac leaves, and the fluid or solid extracts from these materials or from quebracho wood and quercitron bark or other tannin-containing materials; tannic or gallic acid; and chrome tannage or other tannage solutions. The statistics presented in Table 92 show an increase in every item for the census of 1905 as compared with that of 1900, the largest increase in amount being in capital and the next largest in value of products. In common with most of the industries shown, the increase in capital is represented by a much larger percentage than the increase in value of products.

TABLE 92.—*Tanning materials—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	47	33	14	42.4
Capital	$7,396,313	$1,559,157	$5,837,156	374.4
Salaried officials, clerks, etc., number	168	64	104	162.5
Salaries	$260,472	$76,025	$184,447	242.6
Wage-earners, average number	1,891	554	1,337	241.3
Total wages	$788,451	$207,337	$581,114	280.3
Miscellaneous expenses	$518,033	$78,974	$439,059	556.0
Cost of materials used	$3,358,104	$1,020,763	$2,337,341	229.0
Value of products	$5,615,590	$1,713,284	$3,902,306	227.8

The statistics of Table 93 show an increase in every item for 1905 as compared with 1900 except in the quantity and value of ground bark, ground sumac, hemlock extract, and sumac extract, and in the value of "all other products." The largest increase in both quantity and value is found in the item of ground and chipped wood, in which there was an increase of 636,858,006 pounds, or 336.4 per cent in quantity and of $6,370,994, or 336.6 per cent in value, but it will be observed that these figures are based on reports of estimates of materials used. The next largest increase is found in oak and chestnut extract, in which an increase of 121,846,126 pounds, or 351.4 per cent, in quantity corresponds with an increase of $1,750,065, or 264.7 per cent, in value. As shown by the table the proportionate increases and decreases in quantity among the different products are remarkably consistent with the corresponding increases and decreases in value. It is believed that if the returns of the industry in tanning hides could be obtained in detail, the quantity of tanning materials, and especially of tanning liquors used, would be greatly increased, since many establishments in this industry manufacture their own tanning materials.

TABLE 93.—*Tanning materials—quantity and value of products: 1905 and 1900.*

KIND.	1905		1900	
	Quantity (pounds).	Value.	Quantity (pounds).	Value.
Total	1,132,307,832	$13,943,190	424,120,026	$5,548,522
Ground bark	[1]74,847,272	[1]269,460	[2]136,380,000	[2]696,125
Ground and chipped wood	[3]826,147,006	[3]8,263,884	[4]189,289,000	[4]1,892,890
Ground sumac	5,129,333	65,630	9,528,800	114,660
Hemlock extract	18,833,450	406,619	35,591,329	572,882
Oak and chestnut extract	156,520,123	2,411,184	34,673,997	661,119
Sumac extract	4,093,619	95,958	4,349,742	103,085
Tannic acid	5,165,500	200,136	(5)	(5)
Tanning liquors	41,571,529	1,618,821	14,307,158	353,143
All other products	....	611,498	....	1,154,618

[1] Includes 36,553,420 pounds, with an assigned value of $18,277, consumed in establishments where manufactured; and also the tanning materials produced by establishments engaged primarily in the manufacture of other products.
[2] Includes 109,352,000 pounds, with an assigned value of $546,760, consumed in establishments where manufactured; and also the tanning materials produced by establishments engaged primarily in the manufacture of other products.
[3] Includes 825,181,300 pounds, with an assigned value of $8,251,813, consumed in establishments where manufactured; and also the tanning materials produced by establishments engaged primarily in the manufacture of other products.
[4] Estimated.
[5] Included in "all other products."

Table 94 shows that the principal increases in the number of establishments at the census of 1905 as compared with that of 1900 were in Virginia, North Carolina, and Tennessee, and the principal decreases in Pennsylvania and New York. Practically all of the gains were in the Southern states, which in 1905 contained more than half of the establishments of the country. Virginia ranked first in 1905, and Pennsylvania first in 1900.

TABLE 94.—*Tanning materials—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1]51	[2]47
California	2	2
Connecticut	1	......
Florida	2	1
Illinois	......	1
Kentucky	1	1
Maryland	......	2
Massachusetts	3	1
Michigan	1	1
New Jersey	7	8
New York	2	6
North Carolina	5	......
Pennsylvania	5	11
Tennessee	5	1
Virginia	13	8
West Virginia	4	4

[1] Includes 4 establishments engaged primarily in the manufacture of other products.
[2] Includes 14 establishments engaged primarily in the manufacture of other products.

Virginia and New Jersey, which shared the second place in 1900, passed to the first and second rank, respectively, at the census of 1905. North Carolina, which did not appear at the census of 1900, Pennsylvania, which stood first at that census, and Tennessee, which was in the sixth rank in 1900, now share the third place in rank. West Virginia has held the fourth rank at both censuses. Massachusetts has passed from the sixth to the fifth rank. California, which held the fifth, Florida the sixth, and New York the third place in 1900, now share the sixth place in rank. Connecticut, which did not appear in 1900, with Kentucky and Michigan, which both held the sixth place in 1900, now share the seventh place in rank.

TABLE 95.—*Tanning materials—value of products, by states: 1905 and 1900.*

STATE.	1905	1900
United States	$5,673,100	$3,108,872
Massachusetts	204,725	(1)
New Jersey	288,727	399,481
New York	(1)	301,756
North Carolina	634,128	......
Pennsylvania	482,862	753,182
Tennessee	720,255	(1)
Virginia	739,144	470,223
West Virginia	240,965	232,365
All other states[2]	2,362,294	951,865

[1] Included in "all other states."
[2] Includes in 1905 California, Connecticut, Florida, Kentucky, Michigan, and New York; in 1900, California, Florida, Illinois, Kentucky, Maryland, Massachusetts, Michigan, and Tennessee.

The statistics of Table 95 show that as measured by the value of products in the states which are reported

separately at each census, Virginia, which stood second in rank at the census of 1900, stands first at the census of 1905. Tennessee, which was combined with "all other states" in 1900, now ranks second, and North Carolina, which did not appear at the census of 1900, ranks third. At the earlier census the value of the product of "all other states" exceeded that of any single state specially enumerated. This condition was still more marked at the census of 1905, notwithstanding the fact that the returns for Massachusetts and Tennessee were shown separately, because of the increase in the number of establishments in these states.

The table also shows for those states whose returns have been presented separately at each census that, while there has been an increase in the returns for Virginia and North Carolina, there has been a decrease in the returns for New Jersey and Pennsylvania. Inspection of the returns of the individual establishments shows that the decrease in New Jersey and Pennsylvania has been due to the growing remoteness of natural raw material.

TABLE 96.—*Tanning materials—quantity and cost of principal materials used: 1905 and 1900.*

KIND.	1905	1900
Hemlock, oak, and chestnut bark:		
Tons	98,468	93,104
Cost	$706,865	$436,071
Wood:		
Cords	247,295	27,813
Cost	$750,591	$86,728
Quebracho wood:		
Tons	4,904	(1)
Cost	$816,817	....
Sumac leaves:		
Tons	4,476	11,538
Cost	$93,959	$176,353
All other materials	$466,916	$155,469

[1] Included in "all other materials."

The statistics of Table 96 show an increase at each census for every item except sumac leaves, which show a decrease in both quantity and value. The general increase is in accordance with the increase noted in the value of products in Table 95.

It is evident when we consider the nature of this industry that a complete presentation of it can not be made for several reasons. In the first place, logwood and other materials of the dyestuff industry are used to a certain extent in treating leather, but as there is no information at command by which to determine what portion of the logwood is used in each industry, the whole has been accredited to dyestuffs. Some tanning materials, on the other hand, are used in dyeing textiles, and as in this instance also no separation can be effected, they are all included in the class now under treatment. This constitutes an offset in the bookkeeping. A more serious difficulty is met with in the production of tanning materials in tanning factories in which they are consumed in further manufacture.

The extent to which tanning materials from all sources are used in the manufacture of leather is shown in Table 97, the data being taken from Census Bulletin 57.

TABLE 97.—*Tanning materials used in the manufacture of leather: 1905 and 1900.*[1]

KIND.	1905	1900
Hemlock bark:		
Cords	1,000,328	1,170,131
Cost	$8,471,292	$7,347,242
Oak bark:		
Cords	422,269	445,934
Cost	$3,765,509	$3,174,995
Oak bark extract:		
Barrels	214,391	54,231
Cost	$2,300,395	$550,065
Quebracho extract	$2,490,487	$292,133
Chemicals	$2,847,441	$2,257,751
All other materials used in tanning	$5,154,870	$3,395,261

[1] Census of Manufactures, 1905, Bulletin 57, page 37.

Examination of the data given here shows that the statement made at the census of 1900 practically holds good to-day. It was as follows:[1]

The early tanners were conservative in adopting new processes. Various tannages and substitutes for oak and hemlock bark, which furnished all the tannin of former years, have come into wide use. Standard tannages are now made from hemlock and oak barks, from their extracts, from gambier, sumac, and quebracho, and from chemicals. Mechanical devices have shortened the time required for getting good results, but the tanner is constantly on the alert to secure something that will diminish the number of weeks he is compelled to wait while his hides are assimilating the liquors in which they are placed. Some such shortening process as that employed in the manufacture of kid or morocco is confidently anticipated by manufacturers of sole leather, calf, upper, etc. In the case of kid, hyposulphite of sodium added to the chromium compounds makes the tannage more permanent, while the desired results are obtained in a shorter time. To this discovery is due the sudden growth of a most important branch of leather manufacturing.

Notwithstanding the numberless inventions that have to do with the chemical side of tanning, hemlock and oak bark still furnish the great bulk of the material upon which the manufacturers of leather rely for their tannin. This is accounted for by the practically unlimited supply and the satisfactory results obtained through their use. Inventive genius has exhausted almost every expedient for getting the last particle of tanning material from the bark, so that, whereas not long ago a large percentage of tannin was lost to the manufacturer, he is now able to utilize practically all that the bark is capable of yielding.

The process of chrome tannage above referred to is described by Thorp[2] as follows:

Chrome tannage, or tawing with chromium salts, has been chiefly developed in this country and is now in general use here. The principle of the process consists in precipitating an insoluble chromium hydroxide or oxide on the fibers of a skin which has been impregnated with a soluble chromium salt, usually potassium bichromate; basic chromium chloride, chromium chromate, and chrome alum are also used. The skins, having been limed, unhaired, fleshed, bated, drenched, and scudded, are worked in a solution of potassium bichromate to which some common salt has been added, together with one-fourth to three-fourths of the theoretical amount of hydrochloric or sulphuric acid necessary to liberate all the chromic acid (CrO_3). After several hours, when the skin shows a uniform yellow color when cut through the thickest part, it is removed, the excess of water pressed out or drained away, and the

[1] Twelfth Census, Manufactures, Part III, page 716.
[2] Frank Hall Thorp, Outlines of Industrial Chemistry, 1905, page 540.

skin worked in a bath of sodium bisulphite ($NaHSO_3$), or thiosulphate, to which has been added some mineral acid to liberate the sulphur dioxide:

$$(1)\ K_2Cr_2O_7+2\ HCl=2\ KCl+H_2O+2\ CrO_3.$$
$$(2)\ Na_2S_2O_3+2\ HCl=2\ NaCl+H_2O+S+SO_2.$$
$$(3)\ 2\ CrO_3+3\ SO_2+3\ H_2O=3\ H_2SO_4+Cr_2O_3.$$

The chromic acid is absorbed by the fiber and is later reduced in situ by the sulphurous acid. It is necessary to use a strong solution of the reducing agent, so that the reduction may be fully accomplished before the chromic acid has time to "bleed" from the skin. The strength of solutions recommended vary somewhat in the various processes, but are usually made from 10 to 30 grams per liter for the bichromate, and 30 to 50 grams for sodium thiosulphate. Calculated on the weight of the skin, from 4 to 9 per cent of bichromate, and about 15 per cent thiosulphate are usually employed. The amount of chromic acid fixed on the fiber is about 4 to 6 per cent, calculated as bichromate, $K_2Cr_2O_7$.

Chrome leather is tough and resists moisture very thoroughly. On this latter account, skins which are to be dyed should be introduced into the dye at once after reducing and washing, for if allowed to dry the dyeing is incomplete. The leather may be heated to 80° C. or more without injury, and hence can be dyed with some of the alizarin colors. It is a very rapid process, the time of steeping in the chrome bath being only a few hours and even less in the reducing bath. It is a very light tannage, and on thick skins has considerable tendency to contract the fiber, and so is not used for sole or upper leathers. It is chiefly employed for glazed kid, calf kid, and glove leathers. The tanned or colored skins are oiled and stuffed before drying.

Table 98 sets forth the imports and exports of tanning materials for the years ending June 30, 1891 to 1905, as taken from Commerce and Navigation of the United States, published by the Bureau of Statistics.

TABLE 98.—TANNING MATERIALS—IMPORTS FOR CONSUMPTION AND DOMESTIC EXPORTS: 1891 TO 1905.

YEAR ENDING JUNE 30—	IMPORTS.														DOMESTIC EXPORTS.
	Sumac, extract of.		Sumac, ground.		Sumac, unmanufactured.		Hemlock bark.		Hemlock extract.		Extracts other than hemlock.		Hemlock and other extracts (value).	Other articles in crude state used in tanning, not specially provided for (value).	Bark and extracts for tanning (value).
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Cords.	Value.	Pounds.	Value.	Pounds.	Value.			
1891	2,399,028	$77,152	11,412,297	$235,729	2,953,202	$65,802	57,255	$274,426	768,710	$14,958	3,310	$229	....	$2,603	$241,382
1892	1,902,089	68,853	10,822,614	225,891	2,841,200	60,657	53,019	256,346	....	....	12,973	408	....	1,918	239,708
1893	2,880,210	108,447	14,363,922	289,953	3,817,568	70,152	50,689	241,244	....	....	672	71	....	8,361	232,269
1894	1,277,609	54,535	8,315,551	191,333	970,207	21,427	46,173	212,350	....	....	....	....	....	10,630	271,236
1895	1,604,024	53,260	12,242,216	236,541	2,203,645	40,021	47,286	230,943	....	....	....	....	$3,470	16,629	290,362
1896	2,472,923	78,504	13,349,233	231,324	1,027,824	24,861	43,964	214,891	....	....	....	....	19,046	23,499	354,007
1897	2,907,521	84,150	18,530,104	245,992	2,117,439	30,554	....	....	....	....	....	....	....	....	241,979
1898	1,266,542	48,399	8,336,117	121,461	3,754,307	62,553	....	....	....	....	....	....	....	....	329,994
1899	1,133,662	38,709	14,156,344	202,605	3,011,810	42,297	....	....	....	....	....	....	....	....	369,693
1900	1,419,827	50,295	10,644,001	233,846	1,048,955	20,800	....	....	....	....	....	....	....	....	376,742
1901	1,613,178	52,105	9,935,746	179,801	1,422,822	26,138	16,749	65,313	....	....	....	....	....	46,739	386,238
1902	1,431,354	45,375	13,047,249	209,324	1,204,030	20,886	24,901	103,930	....	....	....	....	....	82,913	288,012
1903	1,356,020	50,681	13,659,289	199,290	1,131,629	16,553	17,041	75,283	....	....	....	....	....	56,592	239,786
1904	1,341,762	50,045	18,007,931	269,459	2,660,936	38,723	14,147	63,632	....	....	....	....	....	92,919	291,783
1905	1,213,494	38,572	16,413,560	235,403	3,745,016	51,162	13,492	64,098	....	....	....	....	....	157,612	552,909

CLASS XIII.—PAINTS AND VARNISHES.[1]

The products of this class embrace pigments, including dry white lead (basic lead carbonate, corroded lead, ceruse), sublimed white lead (basic, oxy-, or anhydrolead sulphate usually containing some zinc oxide), dry white zinc (zinc oxide, Chinese white), zinc lead white (composed of about equal parts of lead sulphate and zinc oxide), leaded zinc oxide (zinc oxide containing varying amounts of lead sulphate), lead oxides (litharge, lead monoxide, red lead, minium, orange lead, orange mine, orange mineral), lampblack and other carbon blacks (vegetable black, gas black, ivory black, animal black, Frankfort, German, or drop black, candle black, graphite, plumbago), barytes (barium sulphate, heavy spar, "sugar," blanc fixe), fine colors (artists' colors, including among others true vermilion, Chinese vermilion, cadmium yellow, true chrome green, cobalt green, cobalt blue, ultramarine blue, Chinese blue, ceruleum, umber, Vandyke brown, sepia, and bister), iron oxides and other earth colors (rouge, light red, Indian red, red oxide, Venetian red, purple oxide, scarlet red, burnt sienna, burnt umbers, and other colors obtained artificially from iron compounds or iron and other earthy minerals), dry colors (including all other pigments in the dry condition either simple or compounded), and pulp colors sold moist; paints, including white lead and other white pigments in oil, "paints in oil and in paste," and "paints in oil already mixed for use;" varnishes and japans, including oleoresinous varnishes, spirit varnishes, dammar and similar turpentine and benzine varnishes, pyroxylin varnishes, drying japans, dryers, baking japans and lacquers, and enamels, fillers, including liquid, paste, and dry fillers and putty; and water paints and kalsomine, including water paints dry or in paste, and water paints already mixed for use.

This classification, therefore, covers many forms of industry, such as the corroding of lead; roasting lead to form the oxides; volatilizing and oxidizing galena to form sublimed lead; distilling zinc and burning its vapors to produce zinc white; grinding and bleaching barite, heavy spar, cawk, or lead bloom to form barytes, or the artificial formation of barium sulphate to produce blanc fixe; thermolyzing hydrocarbons and other carbonaceous compounds to produce carbon blacks, the electric furnace production of artificial

[1] Including bone, ivory, and lamp black.

graphite; and the large number of chemical processes through which a great variety of colors are formed, the mechanical processes of grinding colors in oil or other vehicles to produce paint, and the physical process of dissolving gums in solvents to produce varnishes.

TABLE 99.—*Paints and varnishes—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	664	615	49	8.0
Capital	$77,149,357	$60,834,921	$16,314,436	26.8
Salaried officials, clerks, etc., number	4,455	3,731	724	19.4
Salaries	$5,725,941	$5,040,301	$685,640	13.6
Wage-earners, average number	11,833	9,782	2,051	21.0
Total wages	$6,368,767	$4,971,697	$1,397,070	28.1
Miscellaneous expenses	$9,720,791	$5,122,381	$4,598,410	89.8
Cost of materials used	$60,030,070	$44,844,229	$15,185,841	33.9
Value of products	$91,487,326	$69,922,022	$21,565,304	30.8

The statistics of Table 99 show an increase in every item, particularly noteworthy being those in value of products and in capital, $21,565,304 and $16,314,436, respectively. The largest proportional increase, 89.8 per cent, was in miscellaneous expenses, while cost of materials ranked next, the relative increase in this latter item slightly exceeding that in value of products. It is evident that there has been a material development in the industry since the last census, the increase in the value of products in particular reported for the five-year period at the census of 1905 being markedly greater than the corresponding increase in the ten-year period between the censuses of 1890 and 1900.

Table 100 shows, for the censuses of 1900 and 1905, the quantity and value of the different products of the paint and varnish industry, including bone, ivory, and lamp black, for all establishments where they were manufactured either as principal or subsidiary products, including also the quantity and value of such products as were consumed in processes of further manufacture in the same establishments where they were originally produced.

The statistics of Table 100 show an increase in every item except in the quantity of dry white lead, dry colors, and of liquid dryers, the value of iron oxides and other earth colors, and in both the quantity and value of paints in oil, in paste. In the case of both the dry colors and the liquid dryers the value has increased, which would indicate that superior and more efficient articles are being produced thereby rendering a smaller quantity adequate for a given amount of work. It may be mentioned that both of these products are used in the compounding of paints ready mixed for use, that they may therefore be consumed in such further manufacture in the establishment where originally produced, and that there is, as already pointed out, an increasing tendency on the part of manufacturers to pursue this practice; it has not, however, been possible in this investigation to ascertain definitely the quantities so used. The decrease in both the quantity and value of the paints in oil, in paste is more than offset by the increase in quantity and value of both white lead in oil and in paints ready mixed for use, which indicates a growing tendency on the part of the consumer to mix his colors at his convenience and to suit his own taste, or to use the ready mixed paints in preference to buying separately the colored paint in oil, in paste and the vehicle, and then compounding them for use.

TABLE 100.—*Paints and varnishes—quantity and value of products: 1905 and 1900.*

KIND.	1905		1900	
	Quantity.	Value.	Quantity.	Value.
White lead, dry, tons	[1] 120,046	[1] $11,761,909	[2] 127,346	[2] $9,317,765
Oxides of lead, tons	[3] 36,663	[3] 4,001,775	[4] 32,233	[4] 2,958,184
Oxides of zinc, tons	58,743	4,330,394	37,557	2,718,700
Lampblack, pounds	20,298,385	640,701	7,670,931	425,028
Fine colors, pounds	8,030,330	1,091,853	3,898,447	1,009,096
Iron oxides and other earth colors, tons	[5] 24,723	[5] 342,816	17,454	367,987
Dry colors, tons	[6] 61,894	[6] 4,550,295	75,909	3,655,718
Pulp colors sold moist, pounds	25,505,482	931,131	20,060,935	861,531
White lead, in oil, tons	[7] 114,816	[7] 11,790,482	59,506	6,127,960
Paints in oil, in paste, tons	67,021	8,892,755	95,710	11,751,240
Paints ready mixed, gallons	22,755,018	20,771,387	17,437,311	15,302,481
Oil and turpentine varnishes, gallons	[8] 17,929,403	[8] 16,170,614	14,804,251	14,530,159
Alcohol varnishes, gallons	[9] 1,542,562	[9] 2,202,645	553,432	921,169
Pyroxylin varnishes, gallons	[10] 458,361	[10] 562,629	171,127	187,626
Liquid dryers, gallons	[11] 5,201,187	[11] 3,998,635	6,564,370	3,085,954
Liquid fillers, gallons	1,059,948	786,517	123,552	112,921
Putty, pounds	43,931,556	728,468	17,287,323	238,427
Water paints, dry or in paste, pounds	28,457,447	936,607	14,412,653	744,024
All other products	....	14,827,101	....	4,939,215

[1] Including 88,823 tons, with an assigned value of $8,882,300, consumed in establishments where manufactured.
[2] Including 68,811 tons, with an assigned value of $4,816,707, consumed in establishments where manufactured.
[3] Including 4,925 tons, with an assigned value of $492,500, consumed in establishments where manufactured.
[4] Including 1,040 tons, with an assigned value of $95,441, consumed in establishments where manufactured.
[5] Including 310 tons, with an assigned value of $6,200, consumed in establishments where manufactured.
[6] Including 619 tons, with an assigned value of $6,190, consumed in establishments where manufactured.
[7] Including 5 tons, with an assigned value of $500, consumed in establishments where manufactured.
[8] Including 605,684 gallons, with an assigned value of $466,377, consumed in establishments where manufactured.
[9] Including 2,200 gallons, with an assigned value of $3,432, consumed in establishments where manufactured.
[10] Including 5,800 gallons, with an assigned value of $6,670, consumed in establishments where manufactured.
[11] Including 843,682 gallons, with an assigned value of $649,635, consumed in estalishments where manufactured.

In explanation of the falling off in the quantity of dry white lead reported in 1905, together with the large increase in the quantity of white lead in oil, it may be stated that it appears probable, after a careful scrutiny and checking of the returns for both censuses, that in 1900 a considerable quantity of white lead in oil may have been tabulated as "white lead, dry," for the reason that at that census many establishments returned white lead without indicating whether it was dry or in oil, or furnishing a criterion by which this fact could be definitely ascertained. As each of these substances was specifically called for in 1905, the separation has undoubtedly been made more completely in the present report.

A means of checking the figures for dry white lead is found in the quantity of pig lead used in the paint and varnish industry. Out of the total quantity reported, 40,011 tons were used in the manufacture

of lead pipe, sheet lead, solder, and other manufactures of lead. By calculation based on the residue, the quantities reported for dry white lead have been confirmed.

Although Table 100 gives for the most part a reasonably accurate presentation of the paint and varnish industry so far as those products which are produced for sale are concerned, yet the actual manufacture of these substances for use is probably much greater. It is well known that large establishments engaged in the manufacture of cars and other structures on an extensive scale use large quantities of paint in the preservation and decoration of their products, and it is a sound policy for these establishments to manufacture a material which they consume so largely, but no means are at hand by which to determine the extent of this manufacture. Again it is known that litharge is used in the making of glass. In 1900[1] there were used for this purpose 8,386,106 pounds, costing $490,200, and in 1905, 9,613,649 pounds, costing $555,130. It has long been a practice in some glass works to manufacture there the litharge consumed in the making of the glass, and the item in Table 100 for oxides of lead contains the returns for such litharge in 1900, although not for 1905.

TABLE 101.—*Paints and varnishes—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1]712	[2]652
Alabama	3	....
California	24	16
Colorado	5	8
Connecticut	14	11
Delaware	4	2
District of Columbia	1	2
Florida	1	....
Georgia	6	5
Illinois	66	55
Indiana	16	10
Iowa	5	6
Kansas	3	1
Kentucky	14	12
Louisiana	3	4
Maine	1	3
Maryland	13	16
Massachusetts	35	46
Michigan	19	17
Minnesota	6	7
Mississippi	1	1
Missouri	41	30
Nebraska	8	3
Nevada	1	1
New Jersey	53	60
New York	134	126
North Carolina	2	2
Ohio	77	67
Oregon	4	4
Pennsylvania	112	111
Rhode Island	5	6
Tennessee	4	6
Texas	2	5
Vermont	1	2
Virginia	4	2
Washington	6	3
West Virginia	11	....
Wisconsin	12	7

[1] Includes 48 establishments engaged primarily in the manufacture of other products.
[2] Includes 37 establishments engaged primarily in the manufacture of other products.

At both censuses New York ranked first, Pennsylvania second, and Ohio third in the number of establishments, New York and Pennsylvania both reporting over a hundred establishments at each census. In 1905 Illinois, which stood fifth at the census of 1900, exchanged places with New Jersey, which stood fourth, while a similar exchange occurred between Missouri and Massachusetts for the sixth and seventh places. California ranked eighth with 24 establishments. No other state reported 20 establishments at either census. The largest increase in the number of establishments was in Missouri and West Virginia, which reported a gain of 11 each. Twelve states and territories reported a decrease, the largest loss, 11 establishments, being shown for Massachusetts.

[1] Census of Manufactures, 1905, Bulletin 62, page 25.

TABLE 102.—*Paints and varnishes—value of products, by geographic divisions: 1905 and 1900.*

DIVISION.	1905	1900
United States	$98,804,910	$74,343,037
North Atlantic division	51,987,750	43,330,875
New England	3,888,090	4,009,504
Southern North Atlantic	48,099,660	39,321,371
South Atlantic division	1,614,425	934,288
Northern South Atlantic	1,323,752	748,610
Southern South Atlantic	290,673	185,678
North Central division	39,943,931	27,133,057
Eastern North Central	30,567,947	20,688,785
Western North Central	9,375,984	6,444,272
South Central division	1,770,765	1,039,985
Eastern South Central	1,570,290	860,053
Western South Central	200,475	179,932
Western division	3,488,039	1,904,832
Rocky Mountain and Basin and Plateau	666,519	309,775
Pacific	2,821,520	1,595,057

The statistics of Table 102 show an increase in the value of the products for 1905 as compared with 1900 in every main division and subdivision presented except in New England, in which there was a decrease of $121,414, or 3 per cent. The greatest actual increase in one of the main divisions, $12,810,874, is reported from the North Central division, followed by the North Atlantic with an increase of $8,656,875. The greatest proportional increase, 83.1 per cent, is found in the Western division followed by the South Atlantic with an increase of 72.8 per cent, although the absolute increase in these divisions is relatively small. At each census the North Atlantic division stood first in the value of products, reporting 52.6 per cent, or more than half of the total value returned in 1905, the Southern North Atlantic minor division alone reporting 48.7 per cent. The North Central division ranked second at both censuses, followed by the Western, South Central, and South Atlantic divisions in the order named.

Table 103 sets forth the quantities and values of the more important materials used in the manufacture of paints and varnishes, either as a principal or subsidiary product, as returned at the censuses of 1900 and 1905.

TABLE 103.—*Paints and varnishes—quantity and cost of principal materials used: 1905 and 1900.*

KIND.	1905		1900	
	Quantity.	Cost.	Quantity.	Cost.
Alcohol, grain, gallons	59,064	$138,703	78,309	$175,907
Alcohol, wood, gallons	1,357,682	790,243	310,059	285,510
Barytes, natural and artificial, pounds	47,788,162	218,692	59,675,207	[1] 241,778
Benzine, gallons	13,306,420	1,276,578	10,081,945	1,045,488
Dry colors, pounds	151,986,244	5,322,157	....	4,258,959
Gums, pounds	37,712,476	4,329,031	36,533,632	3,470,695
Iron oxides and other earth colors, tons	63,610	518,950	20,993	[1] 337,733
Lead oxides, pounds	3,690,402	242,475	6,118,576	[1] 429,121
Linseed oil, gallons	20,642,781	7,904,978	16,157,117	7,495,196
Pig lead, tons	129,629	11,214,961	99,052	8,585,688
Turpentine, gallons	7,160,774	3,590,250	6,519,408	2,965,051
White lead, pounds	[2] 61,758,068	[2] 3,046,065	39,689,235	1,970,614
Whiting, pounds	46,598,424	332,836	10,690,441	55,157
Zinc white, pounds	65,408,503	2,814,710	45,178,276	[1] 2,531,037

[1] Included in "dry colors" in Twelfth Census Bulletin No. 210.
[2] Includes 342,014 pounds of white lead in oil, valued at $16,335.

The statistics of Table 103 show an increase in every item except the quantity and value of grain alcohol, of barytes, and of lead oxides. The marked increase in the quantity and value of the wood alcohol used indicates that it has been substituted for the more expensive tax-paid grain alcohol. At the same time, in the pyroxylin varnish industry, other cheaper solvents than grain alcohol have come into use. The decreases in the barytes and lead oxides have probably resulted also from the substitution of other pigments and dryers for these substances. The largest increase in quantity is found in the item of iron oxides and other earth colors, amounting to 42,617 tons, or 203 per cent; while the largest increase in value was that of $2,629,273, or 30.6 per cent, reported for pig lead. A comparison of the amount of pig lead returned in 1900 and 1905 with the dry white lead reported as produced at these censuses tends to confirm the statement previously made that in 1900 the statistics for dry white lead probably included a quantity of white lead in oil also.

The growth of the industry is brought out more clearly in Table 104, which shows the number of establishments, capital, number of employees (including both salaried employees and wage-earners), and value of products reported for the industry at each census from 1850 to 1905, inclusive. Establishments manufacturing paints or varnishes as subsidiary products are not included.

TABLE 104.—*Paints and varnishes—comparative summary: 1850 to 1905.*

CENSUS.	Number of establishments.	Capital.	Number of employees.	Value of products.[1]
1905	664	$77,149,357	16,288	$91,487,326
1900	615	60,834,921	13,513	69,922,022
1890	546	46,945,797	10,973	55,264,711
1880	343	17,960,742	5,280	29,773,317
1870	224	13,949,740	3,504	22,512,860
1860	164	7,402,697	2,216	11,107,342
1850	68	3,217,100	1,579	5,466,052

[1] Includes custom work and repairing.

It will be observed that there has been a steady increase from census to census in every item shown in Table 104, and that there has been no abnormal growth in any one item as compared with the others. The increase in number of establishments is perhaps particularly noteworthy, as many industries showed a falling off in this item at the censuses of 1900 and 1905, as a result of the prevailing tendency to concentration.

Lead oxides and carbonate are found occurring as minerals in the earth and were known to the ancients. Minium was used as a rouge and white lead as a cosmetic by the Romans and Athenians. White lead was also used by the Romans as a body for their paints. Its manufacture was described by Theophrastus about 300 B. C., the method followed being to place sheets of lead in pots with vinegar or wine lees and allow them to stand, whereby, evidently through the action of the carbon dioxide of the air, the basic lead acetate first formed was converted into basic carbonate. This practice with some improvements appears to have been revived in Holland about the sixteenth century. This method is still known as the Dutch process, and is held to give a white lead of superior covering power which is especially valued as a basis for colored pigments in the manufacture of mixed paints.

The process as practiced in this country is described in a circular of the Sterling White Lead Company, as follows:

The pig, or metallic lead, is melted and cast into perforated disks called "buckles," 6 inches in diameter, which are put into pots containing about 1 pint of vinegar. These are placed in rooms holding ten layers, or tiers, 600 to 1,000 pots each. The pots are covered with boards, and layers of spent tan bark placed between each tier. The rooms, technically called "beds," are kept closed from three to four months. During this period the heat and carbonic acid gas generated by fermentation of the tan, together with the acid vapors, combine to corrode the lead into a white flaky substance. This, after it is crushed, screened, ground in water, and dried, forms the white lead of commerce, and is either sold in the dry state to mixed paint and color manufacturers, or ground in linseed oil and sold under corroder's brand for general painting purposes. The works comprise a corroding house 78 by 450 feet, containing 34 corroding beds with a capacity of 60 tons of pig lead each every one hundred days, with ample room for additional beds when required; an iron building containing the buckle machine, pig lead storeroom and machine shop; an iron boiler house equipped with three safety boilers of over 600 horsepower; an exceptionally solid mill building of brick and stone, 75 by 150 feet, four stories high, with a fine light and dry basement; an iron and frame building containing the oxide furnaces and plant, with a capacity of 1,200 tons of red lead and litharge annually; a bark-extracting plant sufficient to supply all the tan bark required for corroding; and a pumping house on the river bank equipped with a fine steam pumping engine. The corroding department is equipped for the "old Dutch" process exclusively (one hundred days' corrosion), but instead of the usual arduous and tedious method of charging and discharging the beds by hand, an electric traveling crane has been introduced. This crane, with a capacity of 3 tons, travels the entire length of the corroding beds, and is utilized for quickly and economically handling the charged pots, the tan

bark, and the corroded product. With this crane it is possible to conduct all the work of charging in a much shorter time and with far fewer hands in proportion to tonnage than is possible in any other "old Dutch" process works in the world. The dust-proof separator has a capacity of 50 tons daily, and there are two double run water mills, with a combined daily capacity of 30 tons. These are run in connection with 14 cedar settling tanks holding about 100 barrels each. The drying rooms on the top floor are furnished with 17 pans with a present capacity for 150 tons a week, with room for additions if necessary. Of these pans, 6 are of the ordinary steam-jacket type, but these are soon to be replaced with new pans of the filter type, which are in exclusive use at this plant. The combined steam and filter drying pan is an invention of the Sterling Company. It comprises an inclined bed, with a false bottom of brass wire cloth covered with filtering fabric, underneath which lies a series of steam coils. Instead, therefore, of having to provide sufficient heat units to evaporate all the moisture from the pulp, only enough is consumed to evaporate the residue that can not be drawn off by gravity and filtration. The saving in coal consumption and in time is apparent at once. But the improvement is still more significant in its effectiveness as an additional washing process. With the ordinary drying pan any acetic acid retained in the pulp after settling remains in the finished product, but with these filter pans it is drained off to the last degree. The oil grinding plant comprises 10 double buhr mills, with a combined daily capacity of 2 carloads of ground lead, with mixers adequate to supply all the mills. The mills are all set on ponderous brick piers extending to solid foundations. An improvement over the ordinary practice with oil grinding consists in allowing all the ground lead to cool in tubs before packing. The mill is also equipped with a pulverizing machine in connection with the automatic packer for reducing the dry lead for barreling. The bark-extracting plant was established for the purpose of insuring a permanently adequate supply of tan for corrosion, as well as to control the quality of the tan provided. Chestnut oak bark is procured from the adjacent country, and the plant is similar to those installed at first-class tanneries, with a vacuum pan for reducing the extract.

Theoretically, 100 parts by weight of lead should yield 124.8 parts of lead carbonate, but in practice the yields vary from 106 to 117 parts of dry white lead. The dross, or skimmings, is used in further manufacture.

In addition to the Dutch process there are the English process, in which litharge is moistened with a solution of lead acetate and the mixture stirred by machinery in an atmosphere of carbon dioxide gas produced by the combustion of coke, and the French process, in which a current of carbon dioxide is passed through a solution of basic lead acetate; but neither of these appears to be in use in this country, though mention is made in literature, but without descriptions, of the use of "quick" processes. Quite a number of electrolytic processes for the production of white lead have been devised, but these do not appear in practice, either because the product is not satisfactory or the operating costs do not compete successfully with those of the older methods.

Sublimed white lead is a strictly American product, the process for its manufacture having been invented and patented by Messrs. E. O. Bartlett and George T. Lewis. This substance is an oxy- or anhydro- lead sulphate which is obtained, without grinding, in the form of an impalpable white powder, having a specific gravity of 6.2, high covering power and wearing qualities, and a high degree of resistance to blackening when exposed to the sulphur compounds occurring in fuel and sewer gases. Furthermore, as it is difficultly soluble, it is free from the poisonous properties which characterize many other lead compounds. The methods employed in its manufacture are described as follows:[1]

Viewed in the gross the process is most simple: The sulphide ore of lead (galena) is heated to the sublimation point and the heated vapors, taking up oxygen from the air, are transformed from the sulphide into the oxy-sulphate of lead. But in detail the transformation is not so easily or simply accomplished. To comprehend thoroughly, we must begin with the ore and follow it through the successive steps of manipulation. The "mineral," as it is called in miners' phrase, after being taken from the mine, is finely crushed, washed, and separated by a gravity process known as "jigging" from accompanying rock and other minerals. In this purified condition it is delivered to the works, where it is again crushed, sized, and inspected. The ores of this district are the purest in the world, and the Picher plant was located at Joplin because of this fact; nevertheless great care is taken in their preparation for the furnaces. The ore thus prepared is charged, with proper carbon fuel, into patent furnaces of different types specially constructed for the different stages of the process. In the last stage the charge is subjected to a heat sufficiently intense to vaporize the lead contents with sufficient access of air to oxidize it into a basic sulphate compound of lead. Powerful suction fans carry these volatilized vapors through a long series of sheet iron pipes or flues up around and through the famous "goose necks," the oxidation being completed during the progress, until the cooled and condensed white vapors of lead oxy-sulphate are finally collected in fabric condensers, which allow the gases of combustion to escape through their meshes. These condensers or collectors are in the form of long bags, hung perpendicularly in a large building, technically known as the "bag house." When it is remembered that in this process a pure lead pigment is carried in the form of vapor through a series of winding flues for a distance of practically 1,000 feet, until it is finally caught and retained in the fabric strainers (bags), it will be realized that the pigment particles must be in a fine state of subdivision. As a matter of fact these ultimate particles of dry sublimed white lead are so fine as to be practically formless—perfectly amorphous. Many pigments, especially those formed by slow processes of precipitation, corrosion, etc., are either crystalline or cryptocrystalline, to use the chemical term; but no other pigment, except lampblack, approaches sublimed lead in fineness and absence of structure; and there is no other pigment to which it can be compared in durability. The two are practically equal in this respect, though there are many instances in which the lettering painted with Picher Sublimed White Lead on a lampblack ground has remained intact after the ground had disappeared.

According to Joseph Hyde Pratt[2] the production of sublimed lead in the United States from 1902 to 1904 was as follows:

YEAR.	Quantity (pounds).	Value.
1904	12,954,000	$550,587
1903	8,592,000	386,640
1902	9,465,500	449,611

Another white pigment produced in this country by the oxidizing smelting of lead and zinc ores in a furnace of special design is known as zinc lead, and is composed principally of lead and zinc oxides. According to Pratt[3] the production in the United States from 1901 to 1904 was as follows:

[1] The Story of Picher Sublimed White Lead, pages 8 to 10.
[2] The Production of Mineral Paints in 1904, page 18.
[3] Ibid., page 19.

YEAR.	Quantity (tons).	Value.
1904	5,779	$404,530
1903	4,500	247,500
1902	4,000	225,000
1901	2,500	150,000

Zinc white, also known as Chinese white, is zinc oxide. According to Dudley,[1] it is produced as follows:

In Leclaire's process zinc is volatilized in retorts, and the hot vapors of metallic zinc issuing are met by a current of air, which completely oxidizes them. The resulting products of combustion are led through a series of pipes and chambers, where the zinc oxide is deposited in the shape of a flocculent, impalpable white powder. This method of production, commonly known as the "French process," was the only one in use until Samuel T. Jones, an American, invented, in 1850, a furnace for the direct sublimation of zincite into the oxide of zinc. Zincite, which occurred as an ore at Sterling Hill, N. J., was soon exhausted, and were it not for the invention of another American, Col. Samuel Wetherill, the paint trade would be dependent for zinc white entirely upon that produced by the more expensive and roundabout French process. Colonel Wetherill's invention consists in mixing the Franklinite ore, mined at Sterling Hill and Franklin, N. J., with finely divided anthracite coal and oxidizing it in a closed furnace, an air blast applied under a perforated grate supplying the necessary oxygen. The products of combustion are carried through a long series of pipes and condensing chambers, in which all the ingredients except the finely divided pure white zinc oxide are removed, the latter being finally collected in long muslin bags, through which the gases of combustion filter. By means of this process the all but inexhaustible deposits of Franklinite ore existing in Sussex county, N. J., were rendered available for the production of a high-grade zinc white, and a large proportion of this pigment as used in this country has its origin in these ore deposits.

Zinc white is not poisonous and is not blackened by contact with hydrogen sulphide or the vapors of other sulphides, a fact which was observed as early as 1779 by Courtois.

The lead oxides are obtained by roasting metallic lead in an oxidizing atmosphere on the hearth of a reverberatory furnace. To obtain litharge (PbO) the lead is oxidized in a current of air at a temperature sufficiently high to melt the oxide as it forms. To obtain red lead, or minium, the lead is oxidized at a temperature below the melting point of litharge in a "drossing" furnace. The mixture of unmelted PbO and particles of metallic lead are ground and levigated in water, the oxide sifted from the particles, and then roasted, with stirring in an oxidizing atmosphere, in a coloring furnace until the desired red color is obtained. Minium has the formula of Pb_2O_3 or Pb_3O_4. Orange mineral, which has an analogous formula but a paler color and a lower specific gravity, is obtained by roasting white lead or white lead skimmings in an oxidizing atmosphere. Orange mineral is used as a base, with eosin and other aniline colors, to produce artificial vermilion. Theoretically, 100 parts by weight of lead will yield 108 parts of litharge and 110 parts of red lead.

[1] Stanton Dudley, The Paint Question, page 9.

Lampblack is obtained by the imperfect combustion of turpentine, rosin, fats, grease, oils, coal tar, and gas through chilling the flames from their combustion, the lampblack being deposited as soot on the cold surfaces against which the flames impinge. It is made largely in this country from natural gas, this variety being known as gas black or carbon black. As produced by deposition of the soot on revolving plates or cylinders it forms one of the purest and most desirable varieties of lampblack. From 2,000 to 8,000 cubic feet of gas are required to produce 1 pound of black.

Barytes is obtained from the mineral heavy spar or tiff by grinding the cleaned and sorted mineral, bleaching it by boiling in acid until the iron and other staining constituents are removed and washing with distilled water, grinding again in buhr mills to the requisite fineness, and grading by elutriation in water. When manganese dioxide is present a special treatment with nitrate of soda, salt, and sulphuric acid is required. Off-colored barytes is used in compounding colored paints. Purified barytes mixed with an equal quantity of white lead produces Venice white; with one-fourth its quantity of white lead (Dutch white), and with an intermediate quantity Hamburg white. Forty parts of cream-floated barytes to 60 parts of zinc oxide produce a paint which has been used in canvasing hams to close the meshes of the canvas so as to prevent the ingress of insects and air. Barytes is used as a base in compounding many colored pigments. Blanc fixe is obtained as a fine white powder by precipitating a barium salt with aluminum or other sulphate. In the moist condition, containing from 25 to 30 per cent of water, it is used in paper making and cotton finishing. In the dry condition it is used as a base for coal tar colors in the preparation of colored pigments. Lithophone is a white pigment consisting of barium sulphate, zinc oxide, and zinc sulphide.

The individual substances constituting the fine colors, iron oxides and other earth colors, and dry colors are so numerous that their mere enumeration would fill a very considerable space. Moreover, many of them are produced in but small quantities and therefore can not be considered separately in the present report. Among the more important are true vermilion, produced by heating mercury with sulphur and treating the product with soda lye, or potash lye and potassium sulphide, or nitric acid, to improve the brilliancy or fire; cadmium yellow, prepared by treating the solution of a cadmium salt with hydrogen sulphide or ammonium sulphide; and chrome green. True chrome green is the chromium trioxide, Cr_2O_3, though some authors include under chrome green the chromium phosphate, $Cr_2P_2O_8$, also, notwithstanding that it is of inferior brilliancy. The former is made by calcining potassium bichromate with boric acid or ammonium chloride, or by precipitating the chromium hydroxide from it with caustic soda or sodium car-

bonate and then calcining the hydroxide; the latter is made by boiling a solution containing potassium bichromate, sodium phosphate, and sodium thiosulphate, when the chromium phosphate is precipitated out and is collected and calcined. Ultramarine is produced by calcining kaolin mixed with soda ash, sulphur, sodium sulphide, sodium sulphate, silica, and rosin. Fine colors are used by artists and in expensive work like the painting of coach bodies.

Iron oxides and other earth colors are artificially produced by calcining the material in its natural form so as to drive off water of constitution or hydration, or carbon dioxide, whereby the shade or color, and sometimes the condition of aggregation of the pigment, are changed. Venetian red and other iron oxides are also produced by precipitating, with lime, the liquors resulting from the pickling of iron or steel with sulphuric acid, and calcining the precipitate.

The term "dry colors" includes any dry pigment suitable for grinding in a medium for the production of paint. Such pigments are produced largely by grinding together their components, as, for example, brunswick green, which is a mixture of barytes, prussian blue, and chrome yellow. A considerable number, however, are produced by strictly chemical means. For example, to produce red shade prussian blue, a mixture of solutions of potassium ferrocyanide and copperas is boiled with sulphuric acid and nitrate of iron till complete oxidation is reached. After washing, solutions of aluminum sulphate and soda ash are added and the blue precipitate is collected, washed, and dried. Chrome yellow is obtained by precipitating lead acetate with potassium bichromate, and satin white by precipitating alum with lime water so as to produce a mixture of calcium sulphate and aluminum hydroxide. These are but a few among many examples. Dry colors are used as pigments in the manufacture of paints and of engraving and printing inks. To be well adapted for these purposes they must possess working quality, which comprises oil absorbing power, "tackiness," stretch, and capacity for being easily wiped off a plate when ground up with oil. The qualities depend mainly on the base used to retain the pigment or dye, but partly on the fineness of the material. The mixtures of an organic coloring matter with inorganic bases such as aluminum hydroxide are styled lakes.

Pulp colors are produced from much the same materials as dry colors, but they have the consistency of a plastic watery pulp. They frequently contain a considerable percentage of clay, which imparts to them certain desirable qualities, since they must be adapted for work on a spreading machine when mixed with sizing. They are chiefly used in coloring window shades, book coverings, wall paper, and glazed paper.

Paints in oil properly include white lead in oil, since this may, like the paints, be used in painting after it has been extended by means of proper vehicles. The chief difference is that paints contain pigments and some turpentine in addition to white lead. A typical composition for paints in oil, in paste, is white lead 10 parts, linseed oil 22 parts, turpentine 2 parts, dry colors 66 parts. According to Hurst [1]—

The quantity of oil required to grind colors into the stiff paste in which they are now so largely sold varies very considerably with different pigments; some only require a comparatively small quantity of oil, others a relatively large quantity. Even with different samples of the same color the proportion will vary a little. Different color makers, too, use different proportions of oil and dry color in grinding. The following table will give some idea of the proportions usually adopted, which are essentially the same both for raw and for boiled linseed oil:

White lead	7½ per cent of oil
Zinc white	22 per cent of oil
Barytes	7 per cent of oil
Putty	18 per cent of oil
Black	27 per cent of oil
Brunswick green	11 per cent of oil
Red oxides	10 per cent of oil
Brunswick blue	11 per cent of oil
Oxford ocher	16½ per cent of oil
Burnt Turkey umber	29 per cent of oil
English umber	20 per cent of oil
Vandyke brown	40 per cent of oil
Siennas	37½ per cent of oil
Black in turps	55 per cent of oil

These figures are based on practical working, but, as mentioned above, are liable to vary a little from time to time.

Paints in oil already mixed for use are those in which linseed or other oil, turpentine or other volatile vehicle, dryer, and varnish or japan have been mixed in such proportions with the pigment as to render the product fit for immediate application. According to Heckel [2] the ready mixed paint industry began in this country about 1860. The proportions and kinds of materials used vary widely, but the following is a typical mixture:

White lead	6.75 per cent
Lead oxide	17.08 per cent
Linseed oil	27.64 per cent
Turpentine	3.75 per cent
Varnish	4.78 per cent
Pigments	40.00 per cent

This category, however, includes many other compositions such as anticorrosive and antifouling paints and roofing paints.

The term varnish embraces a large number of different substances, all of which are viscous liquids containing a volatile solvent or solvents which on evaporation leave behind coherent, flexible, and usually transparent films. The most important of these, because of their more extended use, are the varnishes which are made by dissolving resins, or so-called gums, in linseed oil, and thinning with turpentine. This is generally accomplished by melting the resin in a copper kettle over a fire, adding linseed oil, heating the mixture until the incorporation is complete and then, when partly cooled, thinning with turpentine.

[1] G. H. Hurst, Painters' Colors, Oils and Varnishes, London, 1896, page 353.
[2] Recent Mixed-Paint Literature, page 4.

The large number of such mixtures which are made is indicated by Sabin[1] in the following extract:

If 10 gallons of oil is added to the melted mass, weighing, let us say, 95 pounds, which results from melting 125 pounds of resin, the resulting varnish is said to be an 8-gallon varnish, because it contains 8 gallons of oil to every 100 pounds of resin originally taken. Similarly, 25 gallons of oil would make a 20-gallon varnish, and so on, the varnishes being designated by the proportion of oil to the hundred pounds of unmelted resin, and nothing is said about the turpentine which is, to some extent, a variable quantity. Of course this is purely a factory nomenclature. The purchaser knows the varnishes he buys by certain descriptive or trade names, and, as in every other business, a name which takes the public fancy is very valuable. Further, the varnish as it comes out of the kettle is not usually of the same composition as any varnish sold, because, in order to get certain qualities, it is necessary to mix varnishes made in different ways and of different resins. It will be obvious that if the maker has, for example, three tanks of 10-gallon varnishes, made respectively of Zanzibar, Kauri, and Manila resin, and also three tanks of 30-gallon varnishes made from the same resins, he is in a position to supply nine different kinds of 20-gallon varnish, each differing from the others in certain properties peculiar to each mixture, and also in price; making each of these mixtures from two tanks, and an indefinite number by mixing them in a more intricate manner.

It would be indeed remarkable if some of these 20-gallon mixtures were not better for some special purpose, or even for general use, than any possible 20-gallon varnish, made from a single resin, just as it comes from the kettle. It will also be obvious that an indefinite number of 12-gallon, 15-gallon, 18-gallon, 22-gallon, 25-gallon, and 28-gallon varnishes may be made from these same tanks, and if, in addition, the manufacturer has a set of tanks of 8-gallon, 16-gallon, and 20-gallon varnishes, each set representing, say, these same three resins, the number of possible combinations passes imagination. It is to be further remembered that varnishes are made with as little as 3 gallons of oil and as high as 60; that the more important resins are sold in from two to ten grades, and that the number of these resins is very great and is constantly increasing. It will be seen that a knowledge of the qualities of the various varnishes, and especially of their effect in mixtures, is of as much importance as knowing how to manipulate the materials in the kettle, and the expert, to be an expert, must be intimately and practically acquainted with the use to which the varnish is to be put and the way in which it is necessary to apply it, and how these uses and conditions vary. He should, therefore, have as the simplest foundation a good working knowledge of the furniture trade, of wagon and carriage building, of railway engines and coaches, of ship and boat construction, and of house painting and decoration. To these he may add the lesser trades and specialties, from the making of oilcloth to the japanning of hooks and eyes, as far as his natural abilities and acquired opportunities may allow.

As Chinese wood oil, or tung oil, corn oil, and other oils are used in place of linseed oil, and rosin oil, benzine, benzol, and other volatile solvents in place of turpentine, the number of oil and turpentine varnishes is enormous and the variety of materials employed in their manufacture is very large.

Spirit varnishes embrace turpentine varnishes, of which dammar varnish is an example; alcohol varnishes, of which shellac varnish is an example; and asphaltum varnishes, produced by dissolving asphalt in coal tar naphtha, carbon disulphide, and other solvents. Both grain and wood alcohol are used in making alcohol varnishes, the standard shellac varnish of the country being made with 1 pound of shellac to 1 gallon of 95 to 97 per cent alcohol, or about 1 part by weight of shellac to $1\frac{1}{2}$ parts by weight of alcohol. It is expected that a considerable use for denatured alcohol will be found in this industry.

Pyroxylin varnishes or lacquers are formed by dissolving pyroxylin in a mixture of volatile solvents. An example of such mixture, given by Sabin,[2] is 97 per cent of methyl alcohol, 65 parts; amyl alcohol, 25 parts; and amyl acetate, 10 parts; 16 ounces of pyroxylin being dissolved in 1 gallon of this mixture. Colors are dissolved in these varnishes, or pigments are ground up in them so as to be held in suspension in the liquid, and these latter are used as enamels. These varnishes are greatly improved for use with the brush by adding various resins to them, as the body is increased without increasing the viscosity. Pyroxylin varnishes are largely used in covering polished metal surfaces and enameled leather, and in coating incandescent mantles.

Drying japans and liquid dryers shade into one another. An example of a simple dryer is one which is made by heating 1 gallon of linseed oil with 4 pounds of a mixture of lead and manganese oxides, in which the lead oxide is in great excess, to a temperature of from 500° to 600° F. until saponification ensues, and then dissolving the resulting black colored compound in turpentine. Examples of solid dryers are found in litharge, lead acetate, and manganese borate.

Baking japans are hard black varnishes used for producing a glossy black and enamel-like surface on iron, tin, or other materials. Such a japan may be made by cooking asphaltum with linseed oil and thinning the resulting thick mass with turpentine. Lacquers are varnishes which are used for coating instruments and other objects made of brass, nickel, silver, and other bright metals or alloys to prevent their tarnishing. Such a lacquer may be produced by adding to a varnish composed of seed lac 2 parts, sandarac 4 parts, elemi 4 parts, and alcohol 40 parts, alcoholic tinctures of gamboge, dragon's blood, magenta, picric acid, Martin's yellow, or corallin. Enamels are varnishes holding the pigment in suspension. Fillers occur as liquid fillers, paste fillers, and dry fillers and are used to fill the pores of the wood to which the paint or varnish is to be applied, giving thereby a more even surface and economizing the paint or varnish. Fillers are also styled dopes. Liquid fillers are commonly solutions of rosin, but raw or boiled linseed oil may be used as such. An example of a paste filler is a mixture of pulverized quartz with a quick drying varnish. Putty, which is a mixture of whiting with oil, is used in filling holes and crevices before painting, but is also, and probably most largely, used in glazing.

Water paints and kalsomine embrace the mixtures made from lime or whiting, dry colors, size, and water. In making certain of these compositions it

[1] Alvah H. Sabin, The Industrial and Artistic Technology of Paint and Varnish, 1905, page 82.

[2] Alvah H. Sabin, The Industrial and Artistic Technology of Paint and Varnish, 1905, page 113.

was long ago found beneficial to add a certain proportion of milk. It has been found that the benefit was due to the casein in the milk, and as with the development of the creamery industry a large quantity of casein has become available, an extensive industry has grown out of its applications, chief among which is its use in cold-water paints. According to Scherer[1] it is only within a couple of decades that any extensive use has been made of casein for this purpose, though casein has been detected in old paintings. He gives many formulas for casein paints, among which that for "marble lime" color for outside work may be cited. This consists of—

Casein soluble in alkali	100 parts
Caustic lime, from marble	100 parts
Levigated chalk (whiting)	800 parts
Borax	1 part
Ultramarine	2 to 2.5 parts

Casein paints are met with in commerce in the form of paste or liquids, containing the casein in a dissolved condition, but more commonly as dry powders, containing the casein and an alkali in the dry form. When these powders are mixed with water the alkali is dissolved, and this acts as a solvent for the casein. This then forms compounds which become insoluble, after the paint is applied, by exposure to the air, thus holding the pigments on the surfaces to which they have been applied.

Table 105 sets forth the imports and exports of paints and varnishes, for the years ending June 30, from 1891 to 1905, as taken from Commerce and Navigation of the United States, published by the Bureau of Statistics.

TABLE **105**.—*Paints, pigments, and colors, and varnishes, spirits, and "all other"—imports and domestic exports: 1891 to 1905.*

YEAR ENDING JUNE 30—	PAINTS, PIGMENTS, AND COLORS.		VARNISHES, SPIRITS, AND "ALL OTHER."			
	Imports (value).	Domestic exports[1] (value).	Imports.		Domestic exports.	
			Gallons.	Value.	Gallons.	Value.
1891	$1,439,127	$690,698	35,073	$97,298	153,365	$203,285
1892	1,372,052	709,857	38,737	101,692	215,266	293,059
1893	1,466,761	700,308	41,216	111,675	210,067	258,400
1894	980,715	825,987	20,337	54,746	226,760	282,278
1895	1,246,924	729,706	39,095	106,927	256,890	303,959
1896	1,309,041	880,841	40,644	105,551	335,979	362,975
1897	1,387,353	944,536	62,655	159,024	409,569	431,761
1898	1,065,088	1,079,518	32,848	79,702	398,841	422,693
1899	1,207,440	1,447,425	33,227	79,461	436,817	463,547
1900	1,535,461	1,902,367	43,743	103,985	588,545	620,104
1901	1,487,381	2,036,343	46,030	119,888	606,187	611,459
1902	1,603,181	2,096,379	47,703	127,583	619,024	607,685
1903	1,827,110	2,350,937	49,730	131,114	660,553	667,475
1904	1,674,193	2,756,581	39,771	105,898	713,147	726,585
1905	1,524,301	3,126,317	41,536	103,224	747,017	791,578

[1] Includes carbon black, gas black, lamp black, and oxide of zinc, prior to 1898.

CLASS XIV.—EXPLOSIVES.

This class of explosives embraces gunpowder (including blasting powder and all mechanical mixtures of inorganic nitrates with carbon or any carbonaceous substance which does not of itself possess explosive properties), chlorate powders, nitroglycerin, dynamite (including blasting gelatin, gelatin dynamite, and all explosives containing nitroglycerin which are used in blasting), gun cotton (including pyroxylin and all other cellulose nitrates and all nitric esters other than nitroglycerin used as explosives), nitrosubstitution compounds and the explosives of which they are components (joveite, arctic, masurite, and other safety explosives), smokeless powder (including cellulose nitrate-nitroglycerin, nitrosubstitution and all other high-powered powders used as propellants), and fulminates (such as mercury fulminate, fulminating silver, acetylides, hydrazotates and other detonants). Cundill's Dictionary of Explosives, published in 1895, gives the names of upward of one thousand explosives, and the number of explosives has been considerably increased since, but all that occur in commerce in this country are comprised in the above classification. Cartridges, detonators, fuses, and other devices containing explosives for use in guns and in blasting, are classed under "ammunition," while colored fires, rockets, railroad torpedoes, signal lights, and other devices of this nature are classed under "fireworks."

TABLE **106**.—*Explosives—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	124	97	27	27.8
Capital	$42,307,163	$19,465,846	$22,841,317	117.3
Salaried officials, clerks, etc., number	1,289	768	521	67.8
Salaries	$1,797,050	$914,447	$882,603	96.5
Wage-earners, average number	5,800	4,502	1,298	28.8
Total wages	$3,308,774	$2,383,756	$925,018	38.8
Miscellaneous expenses	$1,657,665	$1,096,604	$561,061	51.2
Cost of materials used	$17,203,667	$10,334,974	$6,868,693	66.5
Value of products	$29,602,884	$17,125,418	$12,477,466	72.9

The statistics of Table 106 show an increase in every item for 1905 as compared with 1900, the largest increase in amount being in the item of capital, the next in the value of products, and the least in the item of miscellaneous expenses. The largest percentage of increase is found also in the item of capital and the second largest in the item of salaries.

TABLE **107**.—*Explosives—quantity and value of products: 1905 and 1900.*

KIND.	1905		1900	
	Quantity.	Value.	Quantity.	Value.
Gunpowder, pounds	10,383,944	$1,541,483	5,450,773	$614,290
Blasting powder, kegs[1]	8,217,448	7,377,977	4,774,948	4,780,903
Nitroglycerin, pounds	[2] 51,579,270	7,730,175	[3] 35,280,498	5,532,570
Dynamite, pounds	130,920,829	12,900,193	85,846,456	8,247,223
Gun cotton, pounds	[4] 5,905,958	2,435,805	[5] 2,988,176	1,473,619
Smokeless powder, pounds	7,009,720	4,406,477	3,053,126	1,716,101
All other explosives	....	190,948	....	6,493

[1] A keg contains 25 pounds of blasting powder.
[2] Including 43,643,270 pounds, with an assigned value of $6,110,058, consumed in establishments where manufactured.
[3] Including 31,661,806 pounds, with an assigned value of $4,749,271, consumed in establishments where manufactured.
[4] Including 5,522,796 pounds, with an assigned value of $2,209,118, consumed in establishments where manufactured.
[5] Including 2,139,834 pounds, with an assigned value of $1,069,917, consumed in establishments where manufactured.

[1] Robert Scherer, Casein—Its Preparation and Technical Utilization, translated by Charles Salter, New York, 1906.

The statistics of Table 107 show an increase in every item for 1905 as compared with 1900, the largest increase in value, $4,652,970, being for dynamite, and except for all other explosives the largest percentage of increase in value, 156.8 per cent, for smokeless powder. The largest increase in quantity, 86,062,500 pounds, is shown for blasting powder, and the next largest, 45,074,373 pounds, for dynamite, but the greatest percentage of increase in quantity, 129.6 per cent, is shown for smokeless powder.

A comparison of the statistics for 1900 as given here with those set forth in the report on chemicals and allied products for the census of 1900 shows apparent discrepancies, and it should be stated that it was found that in several of the returns for that census gunpowder and blasting powder were reported together. These returns have been analyzed and separated, with the result that the quantity and value of the gunpowder was found to be less, and the quantity and value of the blasting powder greater, than the published figures for 1900.

Again, at the census of 1900, when discussing in the text the subject of gun cotton or pyroxylin, the statistics for the cellulose nitrates used in the manufacture of pyroxylin plastics, varnishes, and collodion were included in the totals there given. As these cellulose nitrates are used for other purposes than the manufacture of explosives, and as they are of little or no value as explosives, they are omitted from the statistics of both censuses in Table 107.

Furthermore, the returns for 6 establishments manufacturing railroad torpedoes, fuses, and blasting caps, which were included in the statistics for 1900 under "all other explosives," were at the census of 1905 transferred to classifications other than "chemicals and allied products." The values returned for these products in 1900 have therefore been, in the present report, deducted from "all other explosives" and credited to "all other products." The result of these transfers in the accounts is to make the statistics for the two censuses as set forth in Table 107, much more strictly comparable.

The statistics presented in Table 108 show that this industry was represented in about half of the states of the country at the censuses of 1900 and 1905, and that more than half of the establishments at each census were in the states of Pennsylvania, Ohio, and New Jersey. The whole United States shows a gain of 30 in number of establishments, notwithstanding the fact that 6 establishments included in the list for 1900 have at the present census been classified under other categories. One of these was located in California, 1 in Illinois, 1 in Massachusetts, 1 in New Jersey, and 2 in Pennsylvania. The principal increases were in Ohio and West Virginia, each of which gained 7, and in Pennsylvania and Kansas, each of which gained 4. Pennsylvania ranked first at each census, and at the census of 1905 Ohio ranked second and New Jersey third.

TABLE 108.—*Explosives—number of establishments, by states and territories: 1905 and 1900.*

STATE OR TERRITORY.	1905	1900
United States	[1]130	[2]100
Alabama	3	2
California	6	7
Connecticut	1	1
Delaware	1	1
Illinois	5	3
Indian Territory	1	......
Indiana	7	6
Iowa	1	2
Kansas	5	1
Kentucky	1	......
Maine	1	1
Maryland	2	1
Massachusetts	1	2
Michigan	4	5
Missouri	4	1
New Jersey	11	10
New York	6	5
Ohio	16	9
Pennsylvania	40	36
Rhode Island	1	1
Tennessee	3	2
Vermont	1	1
Virginia	......	1
West Virginia	8	1
Wisconsin	1	1

[1] Includes 6 establishments engaged primarily in the manufacture of other products.
[2] Includes 3 establishments engaged primarily in the manufacture of other products.

The statistics of Table 109 show that the North Atlantic division has stood first in rank at each census, the North Central division second, the South Central and Western divisions combined third, and the South Atlantic division fourth, and that in the interval between 1900 and 1905 there has been an increase in every division in value of products. The greatest increase, $7,856,325, has been in the North Atlantic division and the next greatest, $3,416,620, in the North Central division.

TABLE 109.—*Explosives—value of products, by geographic divisions: 1905 and 1900.*

DIVISION.	1905	1900
United States	[1]$30,292,916	[1]$17,186,164
North Atlantic	15,035,556	7,179,231
South Atlantic	1,347,407	542,110
North Central	8,322,367	4,905,747
South Central and Western	5,587,586	4,559,076

[1] Includes products other than explosives reported by establishments engaged primarily in this industry; and also the explosives produced by establishments engaged primarily in the manufacture of other products.

The statistics of Table 110 show an increase in every item, the largest increase in quantity, 53,002 tons, being in mixed acids; the second largest, 44,510 tons, in nitrate of soda; and the third largest, 18,504 tons, in charcoal. The largest increase in any single item of cost, $2,705,691, is for nitrate of soda; the second largest, $1,307,663, for mixed acids; and the third largest, $1,113,108, for glycerin.

Pyrites appears among the materials used in this industry for the first time at this census, and its use marks the introduction into this country of the contact process for the manufacture of sulphuric acid, which is so extensively consumed in the manufacture of explosives. The marked increase in the quantity of nitrate of ammonia used, 3,202,058 pounds, or

539.1 per cent, indicates the marked increase in the quantity both of safety explosives manufactured, and of weak nitric acid residues utilized. It is to be noted that in some instances sulphate of ammonia is employed in place of the aqua ammonia or ammonia liquor mentioned in the table. The increase in the quantity of ether used, 2,167,341 pounds, most of which is produced in the establishments in which it is consumed, corresponds closely with the increase in the production of smokeless powder, particularly that portion of it used in the manufacture of military powders.

Table **110.**—*Explosives—quantity and cost of materials used: 1905 and 1900.*

KIND.	1905		1900	
	Quantity.	Cost.	Quantity.	Cost.
Alcohol, grain, gallons	850,560	$231,353	191,125	$99,166
Aqua ammonia, pounds	997,830	46,916	649,703	11,303
Charcoal, bushels	[1] 2,408,667	446,078	[2] 928,344	114,172
Cotton, pounds	4,515,787	443,998	1,771,221	103,971
Ether, pounds	[3] 3,425,245	479,494	[4] 1,257,904	88,053
Glycerin, pounds	24,561,527	3,129,665	16,983,918	2,016,557
Mixed acids, tons	[5] 92,598	3,093,429	[6] 39,596	1,785,766
Nitrate of ammonia, pounds	[7] 3,796,033	948,307	[8] 593,975	26,742
Nitrate of potash, tons	[9] 4,114	308,644	[10] 3,315	270,186
Nitrate of soda, tons	133,034	5,608,557	88,524	2,902,866
Nitric acid, tons	[11] 20,406	1,646,543	[12] 7,528	601,494
Pyrites, tons	12,256	67,261	....	....
Sulphur, tons	19,574	507,469	12,742	317,383
Sulphuric acid, tons	[13] 49,298	774,361	[14] 40,385	681,934
Wood, cords	5,628	38,780	600	4,800

[1] Includes 1,156,918 bushels, with an assigned value of $214,030, consumed in establishments where manufactured.
[2] Includes 118,419 bushels, with an assigned value of $14,210, consumed in establishments where manufactured.
[3] Includes 3,382,895 pounds, with an assigned value of $473,605, consumed in establishments where manufactured.
[4] Includes 1,222,704 pounds, with an assigned value of $85,589, consumed in establishments where manufactured.
[5] Includes 37,669 tons, with an assigned value of $2,260,129, consumed in establishments where manufactured.
[6] Includes 6,000 tons, with an assigned value of $270,180, consumed in establishments where manufactured.
[7] Includes 2,863,857 pounds, with an assigned value of $715,964, consumed in establishments where manufactured.
[8] Includes 483,975 pounds, with an assigned value of $21,779, consumed in establishments where manufactured.
[9] Includes 1,778 tons, with an assigned value of $133,385, consumed in establishments where manufactured.
[10] Includes 1,468 tons, with an assigned value of $119,642, consumed in establishments where manufactured.
[11] Includes 18,988 tons, with an assigned value of $1,519,040, consumed in establishments where manufactured.
[12] Includes 7,274 tons, with an assigned value of $583,125, consumed in establishments where manufactured.
[13] Includes 30,994 tons, with an assigned value of $526,898, consumed in establishments where manufactured.
[14] Includes 32,366 tons, with an assigned value of $548,222, consumed in establishments where manufactured.

Table 110 differs from other tables of materials used presented in this report in that the statistics for materials produced and consumed are included therein, but it appears that, with the exception perhaps of nitrate of potash, none of the substances enumerated in the table are produced for sale by these establishments, and therefore the statistics for these substances do not appear elsewhere.

Statistics for the explosives industry as a whole and for certain of its products have been reported and published at each census as far back as that of 1840, or from the date of the census at which the newer explosives first appeared for census enumeration. Table 111 presents a comparative summary of this industry from 1840 to 1905.

Table **111.**—*Explosives—comparative summary: 1840 to 1905.*

CENSUS.	Number of establishments.	Capital.	Average number of wage-earners.	PRODUCTS.	
				Pounds.	Value.
1905	124	$42,307,163	5,800	363,748,097	[1] $28,204,517
1900	97	19,465,846	4,502	218,272,834	[1] 16,552,011
1890	69	13,539,478	2,353	98,645,912	10,993,131
1880	54	6,585,185	1,340	(2)	5,802,029
1870	36	4,099,900	973	(2)	4,237,539
1860	58	2,305,700	747	(2)	3,223,090
1850	54	1,179,223	579	(2)	1,590,332
1840	137	875,875	496	8,977,348	(2)

[1] Not including "all other products." [2] Not reported.

The statistics of Table 111 show an increase in every item from 1840 up to 1905 except in the item of establishments, which decreased in number from 1840 to 1870, but which have since constantly increased in number. The total quantity of the product has increased more rapidly than its total value, indicating a cheapening of the product. At the same time the increase in the capital has gone on at a greater rate than that of the value of products. An interesting feature disclosed by this comparison is that whereas in 1840 each man produced on an average 18,099 pounds of powder per year, in 1905 the average was 62,715 pounds, and this increase, which has resulted from the introduction of machinery, from organization, through which the work of each man is rendered more efficient, and from more continuous employment, has taken place in spite of the fact that the manufacture of the modern explosives involves much more complicated and delicate processes than the manufacture of gunpowder. On the other hand, in 1840 the entry "wage-earners" included the salaried employees, since, as a rule, at that time the owner of the establishment worked with his hands in the factory besides performing the duties of salesman and bookkeeper. A fairer condition for comparison in 1905 would follow by combining the salaried officials of that census with the employees. With this product as the divisor, it appears that in 1905 the product averaged 51,312 pounds per man per year.

Table **112.**—*Gunpowder—quantity and value: 1840 to 1905.*

CENSUS.	Quantity (pounds).	Value.
1905	215,820,144	$8,919,460
1900	124,824,473	5,395,193
1890	95,019,174	6,740,099
1880	(1)	3,348,941
1870	(1)	4,011,839
1860	(1)	3,223,090
1850	(1)	1,590,332
1840	8,977,348	....

[1] Not reported.

The statistics of Table 112 as far as given show a steady increase in the quantity and value of the gunpowder returned at each census since that of 1840 except at that of 1880 and at that of 1900, when the total value of products was less than at the preceding cen-

suses. The greatest increase in quantity, 90,995,671 pounds, and in value, $3,524,267, are found for the interval from 1900 to 1905, notwithstanding the fact that all previous intervals covered decades. At all times the term gunpowder, as used in this table, includes the nitrate-sulphur-charcoal powder used in blasting as well as in guns, and since 1857 it has included the nitrate of soda blasting powder as well as the nitrate of potash blasting powder.

TABLE 113.—*Nitroglycerin—quantity and value: 1870 to 1905.*

CENSUS.	Quantity (pounds).	Value.
1905	7,936,000	$1,620,117
1900	3,618,692	783,299
1890	(1)	(1)
1880	3,039,722	1,830,417
1870	(1)	225,700

1 Not reported.

The striking features of Table 113 are the remarkable increase in the quantity of nitroglycerin produced in 1905 as compared with the quantity produced in 1900, and the decrease in the selling price of the same from 1880 to 1900; the increase from 1900 to 1905 was more than 100 per cent. The slight increase in quantity from 1880 to 1900 was accompanied by a decrease in value of over 50 per cent. This marked fall in the selling price of nitroglycerin in recent years is characteristic of the products of many chemical industries.

TABLE 114.—*Dynamite—quantity and value: 1880 to 1905.*

CENSUS.	Quantity (pounds).	Value.
1905	130,920,829	$12,900,193
1900	85,846,456	8,247,223
1890	30,626,738	4,253,032
1880		622,671

The statistics of Table 114 show an increase in every item at each census as compared with the preceding one, the greatest increase in quantity, 55,219,718 pounds, being for the decade from 1890 to 1900, though the increase of 45,074,373 pounds for the five-year period from 1900 to 1905 is proportionately greater. The greatest increase in value, $4,652,970, is shown for the five-year period from 1900 to 1905—due probably to the increased production of gelatin dynamite, ammonia dynamite, and other high-grade explosives.

No marked change of importance is to be noted in the manufacture or composition of gunpowder or blasting powder, but the latter has new competitors in the compositions made by mixing finely divided metals, such as aluminum, or alloys, such as ferrosilicon, with potassium or sodium nitrate or other oxidizing agents. The fundamental conception of these explosive mixtures is not new, for it has long been known that finely divided iron and other metals furnished combustible components to such mixtures, but the metals and alloys now used were not then available.

A detail which has affected yield and cost in the dynamite industry is the introduction of ice machines for use in the manufacture of nitroglycerin. By the use of artificial refrigeration the yield of nitroglycerin from a given mass of acid is increased, the speed of nitration is increased, the danger attending nitration is decreased, and the use of second separators rendered unnecessary. Two methods of refrigeration may be used: (1) The direct expansion system in which compressed ammonia is sent directly through the coils, and (2) the brine system in which the ammonia is sent through the coils in a brine tank, and then the cooled brine is sent through the cooling coils in the nitrator or separator. The brine, or indirect, system is to be preferred, because in case of leakage in the nitrator the rise of temperature is less from the escape of a given mass of calcium chloride brine than it is from the escape of the same mass of ammonia; leakage of the calcium chloride brine is less likely to occur than is that of the compressed and liquefied ammonia; and less ammonia is required in the indirect than in the direct system; and because the indirect system is a better one for discontinuous use.

The quantities of acids and glycerin and the composition of the mixed acids vary somewhat in practice, but the advantage of artificial refrigeration may be illustrated by a concrete example in which the charge of mixed acid is 6,400 pounds, its composition being—

H_2SO_4	61.50 per cent.
HNO_3	34.50 per cent.
H_2O	4.00 per cent.

With such a charge, using the approved method of nitration without refrigeration, 880 pounds of glycerin may be nitrated, and 1,953.6 pounds of nitroglycerin obtained, while by using artificial refrigeration 928 pounds of glycerin may be nitrated and 2,115.84 pounds of nitroglycerin obtained, or an increased yield of 162.24 pounds. With glycerin at 11 cents per pound and nitroglycerin at 15 cents per pound, the increased profit from a single run is $19.05, or from four runs per day, which can easily be effected, $76.20. As a 30-ton machine can easily be installed for $12,000, and as the cost of operation including interest and 10 per cent depreciation will not exceed $6,000 per year, there is a marked advantage in artificial refrigeration.

At the same time the theoretical conditions of efficiency are not yet realized, for the charge of acid cited above is theoretically sufficient to nitrate 1,074.77 pounds of glycerin and to yield 2,651.31 pounds of nitroglycerin, or 535.47 pounds more than is obtained by artificial refrigeration. The yield may probably be brought more nearly to the theory by the employment of dried air in the injector of the nitrator.

It is well known that at times the separation of nitroglycerin from the emulsion in the acid mixture in which it is formed is extremely slow. Dr. Charles L. Reese alleges that this is due to the presence there of silicon compounds, and he overcomes this difficulty

by the addition of a fraction of a per cent of sodium fluoride before nitration, thereby forming silicon fluoride which is eliminated by volatilization.

The spent acid from the manufacture of nitroglycerin treated in a denitrator yields nitric acid of 35° to 40° Baumé, which is used in the manufacture of ammonium nitrate, and by means of this apparatus and of concentrators 95 per cent of the sulphuric acid is now recovered, though 80 per cent was considered a good yield a few years ago. In other works it has become the custom to rebuild the spent acids, as pointed out in the discussion of mixed acids in this report.

According to Whitman Symmes,[1] the dynamites made by the 4 establishments on the Pacific coast have the following composition:

Percentage composition of various dynamites.

Total	100.0	100.0	100.0	100.0	100.0
Nitroglycerin	70.0	60.0	50.0	40.0	30.0
Wood pulp	20.0	16.5	14.0	11.2	4.2
Ground sodium nitrate	7.0	22.5	35.0	46.2	60.0
Middlings	....	....	....	2.2	5.8
Precipitated magnesium carbonate	3.0	1.0	1.0	0.4	....

	40 per cent gelatin dynamite.	Ammonium dynamite.	Stump powder.	Low powder.
Nitroglycerin	36.0	25.0	20.0	5.0
Cellulose nitrate	1.2	....	....	....
Nitrate of ammonia	[1]	20.0	....	....
Nitrate of soda	[1]	40.0	50.0	70.0
Wood pulp	[1]	15.0	5.0	....
Ground coal	[1]	....	20.0	18.0
Sulphur	[1]	....	5.0	7.0

[1] Dope as in ordinary dynamite.

The first five straight wood pulp dynamites are designated "70 per cent," "60 per cent" grade, etc., according to their nitroglycerin contents; whereas in the case of the gelatin and ammonium dynamites they are designated by a grade showing their supposed equivalency. Theory requires that the niter should be very finely ground in order to be intimately mixed in the dope, but practice shows that such powder packs into hard sticks which sometimes miss fire even with XXX caps, hence medium grinding is resorted to.

The most recent advance in the manufacture of cellulose nitrate has been found in the new process, invented by J. M. and W. T. Thomson, which has been introduced at the Waltham Abbey Factory, England.

The object of this invention[2] is the removal of the acids of nitration from the nitrated material after the action has been completed, and without the aid of moving machinery, such as presses, rollers, centrifugals, and the like. The invention consists in the manufacture of nitrated celluloses by removing the acids from the nitrated cellulose directly by displacement without the employment of either pressure or vacuum or mechanical appliances of any kind, and at the same time securing the minimum dilution of the acids. It was found that if water was carefully run on to the surface of the acids in which the nitrocellulose is immersed, and the acids be slowly drawn off at the bottom of the vessel, the water displaces the acid from the interstices of the nitrocellulose without any undesirable rise in temperature, and with very little dilution of the acids. By this process almost the whole of the acid is recovered in a condition suitable for concentration, and the amount of water required for preliminary washing is very greatly reduced. The apparatus which is used for the purpose consists of a cylindrical or rectangular vessel constructed with a perforated false bottom and a cock at its lowest point for running off the liquid. Means are also provided to enable the displacing water to be run quietly on to the surface of the nitrating acids. In a further patent J. M. Thomson and W. T. Thomson propose by use of alcohol to replace the water, used in washing nitrocellulose, and afterwards to remove the alcohol by pressing and centrifuging.

A notable change in practice in the manufacture of smokeless powder in the United States has been in the abandonment of the nitroglycerin-nitrocellulose powder by the Army, and the adoption of a straight nitrocellulose powder of definite nitrogen contents, thus bringing their practice into conformity with that of the Navy. In fact, the continued tendency in military powders is to approach more closely to the principle set forth by Munroe many years ago as governing the ideal smokeless powder, viz, that "it should be composed of a single chemical substance in a state of chemical purity."

The progress in smokeless sporting powder has been characterized by the adoption of a small-grained nitrocellulose powder which is gelatinized and then hardened throughout, in place of the grain that has heretofore been pretty generally in use, which was superficially gelatinized and hardened. The manufacture of such powder is carried on in a stationary vertical vessel of copper, which has cone-shaped ends. Around the lower end is a steam jacket, by which the contents of the vessel may be heated. A rotatable shaft extends downward through a stuffing box in the top of the vessel, or still, to a point near its bottom, and carries six arms extending across it, each arm being attached at its central point to the shaft and at points on the shaft about 8 inches apart, and the ends of the arms reach nearly to the wall of the still. Five of the bars are square in cross section and about 1 inch thick; the sixth bar, which is the upper one, is flattened out so as to form paddles, which slant in the direction of motion of the shaft in such a way as to smooth down the surface of the liquid that is placed in the still.

An orifice at the bottom of the still having been first closed, the vertical shaft carrying its horizontal stirrers is set in rotation and continued in rotation during the whole of the process at a speed sufficient to maintain the particles of gun cotton in mechanical suspension in the water, when the gun cotton and water are introduced into the still as hereinafter described.

Water in which 5 per cent of barium nitrate and 2 per cent of saltpeter have been dissolved is then pumped into the still, through a pipe provided for this purpose, until the still has been partly filled. Finely pulped wet gun cotton is then thrown into the still through an opening in the side of its upper part, this gun cotton not having been as yet subjected to the action of any

[1] Chemical Engineer, vol. 5, 1907, page 422.
[2] P. Gerald Sanford, Nitro-Explosives, 1906, page 73.

solvent. More water in which barium nitrate and saltpeter have been dissolved is then pumped into the still until the surface of the liquid in the still is about on a level with the upper stirrer-blades on the vertical shaft. The opening through which the gun cotton was inserted is now closed, and a previously formed emulsion of from 25 to 50 per cent of amyl acetate in water containing barium nitrate and saltpeter in solution is pumped into the still.

The material now begins to granulate and the progress of the granulation is observed by withdrawing a little of the mixture through a small orifice near the bottom of the still. When granulation has been effected throughout the mass, which is within about five minutes after the introduction of the emulsion into the still was begun, steam is turned into the jacket surrounding the lower portion of the still. The heating due to the steam is continued for a period of five or six hours, and during this time the amyl acetate is distilled and passes over, with the vapors from the heated water, into a reservoir, where the water is separated from it.

After the amyl acetate is thus removed a gate valve in the bottom of the still is opened and the mixture of water and granulated powder is drawn off into a draining tank. After draining it is dried, sized, blended, and packed. The strength and the amount of the emulsion used depend upon the amount and quality of the gun cotton; the best proportions are ascertained by experience. The length of time the heating is maintained depends upon the amount of amyl acetate used and the temperature of the steam in the steam jacket.

The still may measure about 6 feet and 3 inches from its bottom to the upper stirrer-blades and about 5 feet in diameter in its cylindrical portion. In such a vessel the usual charge of gun cotton is 450 pounds, to which is added the dust or very small grains from previous granulations, making a total charge of upward of 700 pounds. The finished powder is colored to suit the taste of consumers.

The invention and introduction of safety powders has gone on rapidly abroad, and to a more moderate extent in this country, since the census of 1900 was taken. Since, through the researches in France, it was shown that ammonium nitrate diminished the temperature of the products of explosion and tended to render explosives containing it safe for use in fiery mines the ammonia powders have had a marked increase in popularity. In the last edition of his book Guttmann[1] gives two tabular lists of modern explosives for use in mines, one of "nitroglycerin safety explosives," and one of "ammonium nitrate and other explosives." In the first list there are enumerated 23 different explosives containing ammonium nitrate, of which grisoutine A contains as much as 90.45 per cent of this substance, while in the second list there are 38 different powders containing ammonium nitrate, one of these, ammonal, being composed of 95 per cent of ammonium nitrate and 5 per cent of powdered aluminum.

Ammonium nitrate has long been used in dynamites in this country, especially since the invention of protected nitrate of ammonia for use in explosives by Russell S. Penniman in 1885, but foreign experts commented unfavorably upon the use of ammonium compounds in conjunction with organic nitrates such as nitroglycerin and gun cotton. It is gratifying to note the indorsement of American practice, shown in the foregoing statement.

A matter of grave importance in connection with the explosives industry is the transportation of the product, for all of it must be carried from the works to the place where it is to be used, and most of it is transported by railroads. When it is considered that the output for the census year 1905, as given in Table 111, was 363,748,097 pounds, and that a carload of explosives contains 20,000 pounds, it is apparent that there was produced each working day in 1904, on the average, 60 carloads of explosives. It is estimated that on the average 10 days are required in which to transport and deliver these consignments, therefore, there would have been each day on the railroads throughout the United States not less than 600 cars full of explosives. As a matter of fact explosives are more often transported in less than carload lots than in full carload lots especially from central depositories or magazines. From observation and experience railroad officials estimate that the cars carrying small lots are five times as numerous as those carrying full loads. It is therefore apparent that the number 600 is but a minimum and that the actual number of cars carrying explosives must be above this number. Some accidents have occurred in this transportation, but the surprise is that they have occurred so infrequently. It must be inferred that the numerous employees who handle these cars and their contents are especially intelligent, faithful, and vigilant.

But as shown by the statistics presented in this report this industry is a rapidly growing one. It is inevitable that it will continue to increase and that the transportation of explosives will become much larger in the future than it has been in the past. With this condition confronting it, the American Railway Association undertook, in 1905, the drafting of regulations governing this transportation, and prior to doing so called upon a committee of experts, consisting of Charles E. Munroe, Henry S. Drinker, and Charles F. McKenna, for advice. This committee reported as follows:[2]

(1) Your committee finds the explosives industry in the United States to be of importance and continually growing in the quantity and value of its output, as shown by Bulletin 210 of the census for 1900.

(2) It finds that the important and extensive industries of mining and quarrying, the many industries which employ the products

[1] Oscar Guttmann, Handbuch der Sprengarbeit, Braunschweig, 1906.

[2] The American Railway Association, Circular No. 616, 1905, page 14.

of mines and quarries, and engineering operations, can not be economically or safely carried on without explosives.

(3) It finds that the well being, comfort, and advancement of our modern civilization is to a large extent dependent upon the utilization of explosive substances, and that the raw materials from which explosives are manufactured, the products of the mines and quarries made available through the use of explosives, and the great variety of articles manufactured from these products, constitute a considerable part of the freight carried by railroads, while the various industries that are fundamentally dependent on the use of explosives give employment to an immense number of persons.

(4) It is of the opinion that the explosives industry is now so well an established feature of our industrial operations that its products must be transported, and that the best interests of all will be conserved by their being publicly transported by the ordinary routes of travel under such restrictions and conditions as will protect the traveler and the carrier without unduly hampering the producer, dealer, or consumer.

(5) It is of the opinion that a carrier has the right to know the character and properties of the goods he carries, for without such knowledge he may be unable either to protect such goods from injury or so to handle and transport them as to prevent their injuring persons and property. He should therefore be definitely informed regarding the composition and properties of all inflammables or explosives or of substances which may, by contact with other substances, form inflammables or explosives which he is called upon to transport. He also has a right to demand a guarantee that any consignment of an inflammable or explosive character offered possesses the same or a higher standard of stability, both as regards its composition and its method of packing, than the previously accepted or standard substance of this class or variety possessed.

(6) It is of the opinion that explosives and inflammables should be started on their way as soon as possible, forwarded as speedily as practicable, and promptly delivered, since the shorter the time they are in the possession of the carrier the less the risk.

(7) To indicate somewhat the magnitude of the risk following the quantity of explosives shipped in a single lot your committee submits the following table, compiled from a table prepared by Her Majesty's inspectors of explosives, and adopted by the United States authorities. In the original table, among other data, is given the distance which a magazine or factory containing the given weight of explosive should be separated from a public railway in order to protect the latter. The conditions we are considering here are the reverse of those named by Her Majesty's inspectors of explosives, for the explosives are on the railroad and the distance is the danger radius about the car for dwellings, churches, and other buildings.

AMOUNT OF EXPLOSIVES.	Danger radius.
3,000 pounds	240 yards.
4,000 pounds	280 yards.
5,000 pounds	320 yards.
10,000 pounds	525 yards.
20,000 pounds	850 yards.
30,000 pounds	1,200 yards.
40,000 pounds	1,525 yards.
50,000 pounds	1,850 yards.
100,000 pounds	3,500 yards.

This danger radius is not the limit of final effect, for glass may be broken, walls cracked, and weak structures shaken down at greater distances, depending on the topography and geology of the locus of explosion. On the other hand, these very features last mentioned may operate to materially diminish the danger radius. It should be said also that these data are derived from a discussion of those obtained in accidental explosions in the past, and represent extreme conditions.

(8) Your committee is of the opinion that the greatest danger which carriers have to contend with in transporting explosives is fire, and that every effort should be made to protect such shipments from fire.

(9) It recognizes a second and more remote cause of danger in friction, percussion, and concussion, and packages containing explosives should be handled and stored in cars with due precaution against these conditions arising. Freight handlers should know that the striking of a corner of a wooden box smeared with nitroglycerin against the wooden floor of a platform or car might give rise to an explosion.

(10) It recognizes a third cause of danger in high temperatures, which may start or promote decomposition and facilitate leakage. The practical application of this is that it is more hazardous to transport certain explosives in very warm weather, and that they should never be placed near a source of heat.

(11) Holding the above expressed views, your committee calls attention to General Notice No. 174B of the Pennsylvania Railroad Company, dated August 21, 1905, entitled "Information and Regulations for Shippers and Employees," relative to the "Transportation of Explosives." In our opinion, these regulations are practicable, reasonable, and fair, and, if observed, offer a high degree of protection and insurance of safety.

(12) Your committee is of the opinion that the interests of all will be best advanced; that the danger to life and property will be reduced to the minimum; that trade will be promoted and industries fostered by the adoption by all railroads of uniform regulations governing the transportation of explosives and inflammables, and we advise that such regulations be in general conformity with and on the lines of those now in force on the Pennsylvania Railroad as cited above.

(13) Taking up in greater detail the regulations, your committee recommends:

(*a*) That, to guard against "so-called spontaneous combustion or explosion," no nitroglycerin explosive, or an explosive of this class which gives an acid reaction, or which fails in the stability test, or which contains an insufficient amount of ant-acid, be accepted for transportation.

(*b*) That, as a precaution against leakage, cartridges or sticks of explosives be so packed in boxes that when loaded in cars the cartridges shall always lie upon their sides and never stand upon end.

(*c*) That containers be marked "Explosives—Dangerous" on all sides, and, to admit of the method of stowing recommended in (*b*), they be so marked that the position in which the cartridges lie is indicated.

(*d*) That, as a further precaution against leakage from the boxes and to reduce the chance of explosion by shock, cartridges or sticks be packed in dry sawdust or dry infusorial earth.

(*e*) That, as a precaution against explosion from friction, or shock, care be taken in loading explosives in the car that the packages are so stayed or chocked that they can not shift or fall.

(*f*) That no inflammables, no detonators, or blasting caps, and no acids be shipped in the same car with explosives.

(*g*) That cars carrying explosives be strong box cars in good order and be fitted with air brakes and, in trains, be placed between cars fitted with air brakes.

(*h*) That cars carrying explosives be located so far from the engine as to reduce to a minimum the danger from sparks from the engine.

(*i*) That cars carrying explosives be followed in the train by several cars so as to reduce to a minimum the chances of explosion in case of a rear-end collision.

(*j*) That cars carrying explosives be widely separated in a train from cars carrying petroleum or naphtha. So far as possible cars carrying explosives and cars carrying petroleum or naphtha should go by different trains.

(*k*) That in making up trains no cars carrying pig iron, steel billets, heavy structural metal parts, machinery, or other heavy material, which in a collision might crush adjacent cars, be placed adjacent to a car carrying explosives.

(*l*) That in view of the fact that explosives, containing nitroglycerin or other nitric esters, are more liable to decomposition the higher the temperature, the transportation of these explosives should be limited as much as possible during the hottest months of the summer, and when transported in warm weather every available precaution should be taken to keep the temperature of the car as

low as possible, such, for example, as wetting the car down at water stations.

(*m*) That it is essential that the containers should be so made and of such strength that they will not be broken in transit.

(*n*) That in the transportation of explosives containing a liquid component it is desirable that the containers be lined with a liquid proof lining.

The regulations which have been framed now govern most of the railroads in this country, and a corps of inspectors of explosives has been organized with Maj. B. W. Dunn of the United States Army as chief inspector.

A second significant advance toward protection in the use of explosives is found in the formation during 1907, under the Technological Branch of the United States Geological Survey, of a corps of experts for the inspection of explosives for use in coal mines, and the study of accidents in such mines resulting from explosions.

Table 115 sets forth the imports and exports of explosives during the years ending June 30, 1891 to 1905, as taken from Statistical Abstract of the United States, published by the Bureau of Statistics.

TABLE 115.—EXPLOSIVES—IMPORTS AND DOMESTIC EXPORTS: 1891 TO 1905.

YEAR ENDING JUNE 30—	IMPORTS.				DOMESTIC EXPORTS.			
	Gunpowder.		All other explosives, fulminates, etc.[1] (value).	Total value.	Gunpowder.		All other explosives (value).	Total value.
	Pounds.	Value.			Pounds.	Value.		
1891	34,312	$19,148	$124,528	$143,676	733,834	$88,676	$906,870	$995,546
1892	31,111	29,533	100,977	130,510	903,077	108,276	752,079	860,355
1893	78,306	68,974	124,661	193,635	885,263	105,547	755,966	861,513
1894	85,481	71,285	67,342	138,627	495,566	66,839	935,287	1,002,126
1895	104,990	84,882	96,940	181,822	972,271	102,885	1,174,396	1,277,281
1896	68,993	49,857	77,192	127,049	1,159,935	124,823	1,256,279	1,381,102
1897	87,921	63,722	98,727	162,449	1,086,465	118,001	1,437,317	1,555,318
1898	98,708	79,992	65,123	145,115	1,202,971	139,644	1,255,762	1,395,406
1899	44,405	29,824	160,620	190,444	1,504,624	181,642	1,350,247	1,531,889
1900	31,212	15,835	169,073	184,908	1,612,822	197,438	1,694,166	1,891,604
1901	79,556	38,644	212,895	251,539	1,463,499	193,345	1,518,757	1,712,102
1902	70,776	55,998	268,788	324,786	1,609,910	224,779	1,837,602	2,062,381
1903	76,766	59,778	375,404	435,182	1,112,490	151,658	2,302,852	2,454,510
1904	64,569	53,370	318,599	371,969	965,740	136,383	2,305,213	2,441,596
1905	73,245	55,979	311,527	367,506	1,062,807	149,466	2,410,371	2,559,837

[1] Does not include firecrackers.

CLASS XV.—PLASTICS.

This class embraces pyroxylin plastics (including celluloid, xylonite, fiberloid, viscoloid, pegamoid, pyralin, and the goods wrought from them), pyroxylin or soluble cotton, and the collodion or photographic films, artificial leather, and other products made from it, viscose and its products, rubber substitutes, and all other plastics formed from caoutchouc, gutta-percha, casein, fibrin, gluten, gums, and glue or other cementing material by which sawdust, wood pulp, bone dust, zinc oxide, antimony sulphide, kaolin, and other fillers are held in solid aggregations which may be molded or shaped with lathes and other tools as desired.

TABLE 116.—*Plastics—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	10	8	2	25.0
Capital	$8,689,547	$7,558,720	$1,130,827	15.0
Salaried officials, clerks, etc., number	198	196	2	1.0
Salaries	$334,151	$308,395	$25,756	8.4
Wage-earners, average number	1,847	1,219	628	51.5
Total wages	$863,702	$590,557	$273,145	46.3
Miscellaneous expenses	$528,504	$214,166	$314,338	146.8
Cost of materials used	$1,952,053	$1,255,841	$696,212	55.4
Value of products	$4,877,380	$3,035,656	$1,841,724	60.7

The statistics of Table 116 show an increase in every item, that in value of products being nearly $2,000,000 and that in capital being over $1,000,000. The proportional increase in value of products was, however, much larger than that in capital, amounting to 60.7 per cent against a gain of 14.1 per cent in the latter item. The largest proportional increase, 146.8 per cent, was in miscellaneous expenses.

TABLE 117.—*Plastics—quantity and value of products: 1905 and 1900.*

KIND.	1905		1900	
	Quantity.	Value.	Quantity.	Value.
Pyroxylin plastics, pounds	[1] 2,966,820	$2,671,380	[2] 2,074,708	$2,259,338
Pyroxylin, pounds	[3] 2,986,497	2,777,556	[4] 1,561,604	1,359,490
Rubber substitutes, pounds	254,892	63,724		
Leather substitutes				479,842
All other plastics, pounds	90,820	21,743		
All other products		1,659,274		1,101,845

[1] Includes 593,866 pounds, with an assigned value of $534,404, consumed in establishments where manufactured.

[2] Includes 814,184 pounds, with an assigned value of $732,766, consumed in establishments where manufactured.

[3] Includes 2,914,246 pounds, with an assigned value of $2,710,149, consumed in establishments where manufactured.

[4] Includes 1,467,147 pounds, with an assigned value of $1,276,419, consumed in establishments where manufactured.

The statistics of Table 117 show a considerable fluctuation in the character of this industry, as leather substitutes, which appeared at the census of 1900, do not appear at that of 1905, while rubber substitutes and the classification "all other plastics" appear at the present census for the first time. While it is believed that certain of the establishments producing leather substitutes in 1900 have ceased such manufacture, it is believed also that the products of other

establishments were included in other categories at the census of 1905, owing to the form or manner in which they were reported. The three items of Table 117 for which returns appear at both censuses all show an increase for 1905 as compared with 1900, the largest increase in quantity, 1,424,893 pounds, and the largest increase in value, $1,418,066, being shown for pyroxylin, the larger part of which (97.6 per cent in 1905) is, however, consumed in further manufacture in the establishments in which it is produced.

TABLE 118.—*Plastics—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1]14	[2]13
Connecticut	1	.....
Massachusetts	3	1
New Jersey	[illegible]	11
New York	2	1

[1] Includes 4 establishments engaged primarily in the manufacture of other products.
[2] Includes 5 establishments engaged primarily in the manufacture of other products.

It will be seen that at both censuses the manufacture of plastics was largely confined to New Jersey, this state reporting, at the census of 1900, 11 out of a total of 13 establishments for the industry, or 84.6 per cent. At the census of 1905 New Jersey showed a loss of 3 establishments but still reported 8 out of a total of 14, or 57.1 per cent. The industry as a whole showed a gain of 1 establishment at the census of 1905.

TABLE 119.—*Plastics—quantity and cost of materials used: 1905 and 1900.*

KIND.	1905		1900	
	Quantity.	Cost.	Quantity.	Cost.
Acetone, pounds	695,667	$83,481	191,864	$23,024
Alcohol, grain, gallons	8,557	20,858	7,015	16,837
Alcohol, wood, gallons	275,278	204,925	187,381	121,737
Camphor, pounds	1,282,063	457,744	635,111	162,270
Cotton and paper, pounds	1,990,846	288,455	1.006,194	146,430
Dyestuffs and colors, pounds	14,378	8,348	10,278	5,487
Ether, pounds	12,473	7,391	.....	.....
Mixed acids, pounds	2,680,923	137,384	.....	.....
Nitric acid, pounds	3,918,794	200,542	2,971,469	151,266
Oils, gallons	49,509	29,914	87,647	17,321
Sulphuric acid, tons	4,177	73,890	4,157	73,196
Zinc oxide, pounds	393,900	28,417	116,400	8,155

The statistics of Table 119 show an increase for 1905 over 1900 for every item presented for both censuses except in the quantity of oils. The term "oils" includes, among others, rape, mustard, linseed, cottonseed, corn, and petroleum oils and the loss in quantity in 1905 appears to be due to the closing of a factory which in 1900 used a very considerable volume of low-priced oil. An item in which there appears but a slight increase is sulphuric acid, but this fact is at least partly accounted for by the fact that mixed acids were returned separately in 1905, since sulphuric acid, as shown in the discussion of Class I, constitutes an important part of this mixed acid. The largest increase in quantity, 984,652 pounds, is found in the item of cotton and paper, these two being joined because they are used interchangeably as sources of pyroxylin, but, if the nitric acid of the mixed acids be added to the nitric acid reported in 1905, the largest increase in quantity would be found for nitric acid. The largest increase in cost, $295,474, is found in the item of camphor, the expenditure for this material almost trebling since 1900.

TABLE 120.—*Pyroxylin plastics—comparative summary: 1880 to 1905.*

CENSUS.	Number of establishments.	Capital.	Number of employees.	Value of products.
1905	5	$8,639,516	[1]1,838	$4,795,157
1900	7	7,210,548	[1]1,176	2,916,027
1890	12	3,158,487	1,023	2,575,736
1880	6	1,214,000	736	1,261,540

[1] Wage-earners only.

It will be seen that at each census there was an increase in every item presented in this table, except in the number of establishments, which shows a falling off at each census since 1890, due probably to the same tendency to concentration that is to be observed in other industries. The greatest increase in value of products, $1,879,130, and in the number of employees, 662, was reported for the five-year period from 1900 to 1905. The greatest increase in capital, $4,052,061, however, was reported for the period from 1890 to 1900, but in spite of this fact the industry appears to have been almost at a standstill during this period, as the census of 1900 shows the extremely low increase of $340,291 in value of products over the census of 1890. Since 1900, however, the industry apparently has been growing rapidly in importance.

The applications of cellulose are already manifold. Although many have been long known, a very considerable number are of quite recent origin, and new methods of application are constantly being invented or discovered. Probably nothing has done more to facilitate such applications than the discovery of cellulose nitrate, as made by Schoenbein in 1846, and the subsequent discovery of the Hyatt Brothers, in 1869, that by the aid of camphor, the cellulose nitrate, which is known as the heptanitrate, could be converted into the plastic mass known as celluloid, for from these discoveries and the inventions following there has grown up the extensive pyroxylin plastics industry shown statistically above.

Another development based on the use of cellulose nitrates is the artificial silk industry, which has grown from the discovery by De Chardonnet, in 1885, that a solution of pyroxylin could be forced through fine apertures into water so as to form fine threads having the luster of silk and showing a marked capacity for dyes. This industry has attained a large degree of importance in Europe, but, although considerable quantities of its products are imported into the United

States, their manufacture is not yet carried on here. The reason for this lies in the fact that large quantities of grain alcohol and ether are employed in this industry, and it is not found that the cost of these materials in this country has as yet reached a point sufficiently low to permit this artificial silk manufacture to be conducted economically.

Attention was called in the report on chemicals and allied products in 1900 to the invention of viscose by Cross and Bevan and others and the production of plastic masses from cellulose by this means. This invention, resulting from a most elaborate scientific research, has been expected to yield most valuable economic results, but as yet there are no statistics to record here.

A recent development of importance in the plastic industry is in the application of casein as the binder for various materials, as these products are expected to replace the pyroxylin plastics. Scherer devotes a chapter in his book[1] to the "Preparation of Plastic Masses from Casein" and mentions particularly galalith, which is prepared from a specially purified casein.

Constantly extending use is being made of the solutions of cellulose nitrate in the manufacture of oilcloth, linoleum, artificial leather, waterproofed cloth and paper, and especially patent leather.

Table 121 sets forth the imports and exports of pyroxylin plastics, for the years ending June 30, from 1891 to 1905, as taken from Commerce and Navigation of the United States, published by the Bureau of Statistics.

TABLE 121.—*Pyroxylin plastics—imports and exports: 1891 to 1905.*

YEAR ENDING JUNE 30—	Imports (value).	Exports (value).
1891	$10,595	....
1892	43,353	$39,004
1893	57,062	36,597
1894	96,977	85,234
1895	371,873	72,926
1896	337,862	146,354
1897	262,675	149,631
1898	160,836	155,444
1899	249,619	173,771
1900	378,583	174,310
1901	277,461	211,781
1902	213,663	189,974
1903	178,144	249,488
1904	240,501	246,601
1905	166,479	294,979

CLASS XVI.—ESSENTIAL OILS.

The class of essential oils embraces the natural essential oils, both crude and refined (except turpentine and petroleum distillates), artificia essential oils, and witch hazel. The number of different substances included is very large. The Standard Dictionary enumerates 159 different essential oils, all of which except petroleum and naphtha are of vegetable origin, but this does not exhaust the list.

[1] Robert Scherer, Casein—Its Preparation and Technical Utilization, translated by Charles Salter, New York, 1906.

TABLE 122.—*Essential oils—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	52	47	5	10.6
Capital	$723,004	$576,286	$146,718	25.5
Salaried officials, clerks, etc., number	37	39	[1] 2	[1] 5.1
Salaries	$40,002	$24,733	$15,269	61.7
Wage-earners, average number	132	168	[1] 36	[1] 21.4
Total wages	$69,711	$61,415	$8,296	13.5
Miscellaneous expenses	$78,886	$48,763	$30,123	61.8
Cost of materials used	$1,110,470	$588,594	$521,876	88.7
Value of products	$1,464,662	$813,495	$651,167	80.0

[1] Decrease.

The statistics of Table 122 show an increase in every item for 1905 as compared with 1900 except in the number of salaried officials, clerks, etc., and the average number of wage-earners. The value of products shows an increase of $651,167, or 80 per cent, but the largest proportional increase, 88.7 per cent, was reported for the cost of materials.

TABLE 123.—*Essential oils—quantity and value of products: 1905 and 1900.*

KIND.	1905		1900	
	Quantity.	Value.	Quantity.	Value.
Peppermint oil:				
Crude, pounds	41,250	$107,472	147,100	$126,340
Refined, pounds	88,772	362,565	102,068	127,585
Sassafras oil, pounds	30,235	17,673	117,729	37,772
Wintergreen oil, pounds	4,737	15,579	1,300	1,231
Other natural oils, pounds	299,373	522,648	467,319	404,785
Witch hazel extract, gallons	824,874	380,373	110,260	54,649
Artificial oils	....	65,250	....	54,460
All other products	....	7,602	....	9,547

The statistics of Table 123 show an increase in the value of refined peppermint oil, in the quantity and value of wintergreen oil and of witch hazel extract, and in the value of "other natural oils" and of artificial oils, but a decrease in all other items. The decrease in the quantity of peppermint oil, both crude and refined, finds an explanation in the overproduction of this commodity in 1899, which carried the price below that point which made the cultivation of the mint and production of the oil profitable. As a consequence the cultivation has since been much restricted. The reduction in the quantity and value of sassafras oil appears to be due to the fact that this is chiefly a neighborhood industry which is subject to considerable fluctuation. The quantities of other natural oils are subject to similar fluctuations, and it would appear that in 1905 a larger quantity of the more expensive oils was produced than in 1900.

As pointed out elsewhere, in 1900 the census included the neighborhood industries, while in 1905 these were eliminated from the canvass. This difference in methods has had a marked influence on the industries embraced in Class III, Potashes, and Class XVI,

Essential Oils, as these industries are largely pursued by farmers at odd moments between the cultivation of their regular crops. As a result of this canvass in 1900, in addition to the quantities presented in Table 123, there were returned 38,925 pounds of oil of peppermint, valued at $32,074; 1,410 pounds of oil of sassafras, valued at $393; 775 pounds of oil of wintergreen, valued at $1,043; and 11,158 pounds of other natural oils, valued at $7,734. These establishments each, as a rule, produced less than $500 worth of product, and would not therefore be considered in any of the regular Census tabulations.

TABLE 124.—*Essential oils—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1]54	[2]50
California	2	2
Connecticut	9	5
Florida	......	1
Illinois	......	1
Indiana	13	......
Massachusetts	1	1
Michigan	7	6
New Hampshire	1	......
New Jersey	1	......
New York	5	15
North Carolina	......	1
Pennsylvania	9	3
Virginia	4	13
Wisconsin	2	2

[1] Includes 2 establishments engaged primarily in the manufacture of other products.
[2] Includes 3 establishments engaged primarily in the manufacture of other products.

The statistics of Table 124 show a most irregular fluctuation, due probably to the fact that the sources of supply are quite irregular and that, as a rule, these establishments spring into existence in the midst of an abundant native supply and are abandoned when this is exhausted.

TABLE 125.—*Essential oils—value of products, by geographic divisions: 1905 and 1900.*

DIVISION.	1905	1900
United States	$1,479,162	$816,369
North Atlantic	1,160,617	585,972
South Atlantic	9,856	38,772
North Central and Western	308,689	191,625

Table 125 shows that the North Atlantic division held the first rank in the essential oil industry at each census, and at the census of 1905 reported 78.5 per cent, or more than three-fourths, of the total value of products for the industry. The combined North Central and Western divisions ranked second at each census. In both of these divisions the industry shows a marked increase in the value of products for 1905 as compared with 1900, that in the North Atlantic division amounting to 98.1 per cent. There was, on the other hand, a marked decrease in the value of products of the South Atlantic division.

TABLE 126.—*Essential oils—quantity and cost of materials used: 1905 and 1900.*

KIND.	1905		1900	
	Quantity.	Cost.	Quantity.	Cost.
Alcohol, grain, gallons	84,602	$206,255	13,258	$44,888
Essential oils, crude, pounds	107,713	385,773	443,400	331,050
Herbs, leaves, and seeds, tons	2,410	230,666	7,473	148,050
Wood, bark, and roots, tons	59,981	244,823	6,363	25,684

The statistics of Table 126 show for 1905 as compared with 1900 an increase in the value of every article enumerated, and an increase in the quantity of alcohol and of wood, bark, and roots used. The decreases in the quantity of crude essential oils and of herbs, leaves, and seeds used in 1905 as compared with 1900 are quite in harmony with the variations in products shown elsewhere, and point to a smaller use of the cheaper materials.

Table 127 presents the imports and exports of oils, both volatile, or essential, and distilled, for the years ending June 30, 1891 to 1905, inclusive, as taken from Commerce and Navigation of the United States, published by the Bureau of Statistics.

TABLE 127.—*Oils, volatile, or essential, and distilled—imports and exports: 1891 to 1905.*

YEAR ENDING JUNE 30—	IMPORTS.		EXPORTS.		
	Pounds.	Value.	Peppermint oil.		All other (value).
			Pounds.	Value.	
1891	3,459,533	$1,523,491	45,321	$120,831	$65,104
1892	3,451,519	1,676,064	54,987	156,418	68,501
1893	4,022,117	1,654,036	99,629	267,422	79,920
1894	2,861,875	1,102,108	80,225	209,722	64,907
1895	....	1,398,956	87,633	194,616	190,798
1896	....	1,554,289	85,290	174,810	102,487
1897	....	1,885,523	162,492	257,484	146,569
1898	....	1,511,078	145,375	180,811	201,497
1899	....	1,691,257	117,462	118,227	162,358
1900	....	1,859,184	89,558	90,298	166,424
1901	....	1,959,395	60,166	63,672	169,004
1902	....	2,092,371	36,301	54,898	202,983
1903	....	2,156,331	13,033	34,943	252,770
1904	....	2,396,748	42,939	124,728	440,588
1905	....	2,534,723	36,953	135,060	215,860

CLASS XVII.—COMPRESSED AND LIQUEFIED GASES.

This class embraces acetylene, anhydrous ammonia, carbon dioxide (carbonic acid gas, carbonic anhydride, CO_2), chlorine, coal gas, hydrogen, liquid air, nitrogen monoxide (hyponitrous oxide, nitrous oxide, laughing gas, N_2O), oxygen, compound oxygen, sulphur dioxide (sulphurous oxide, sulphurous acid gas, sulphurous anhydride, SO_2), and all gases that are compressed or liquefied for sale.

The statistics in Table 128 show an increase in every item for 1905 as compared with 1900, the largest increase in amount being found in capital and the second largest in value of products. The largest percentage of increase is also found in the

item of capital, and the second largest, in the item of miscellaneous expenses. It is to be noted as indicating the rapid growth of this industry that the smallest percentage of increase, that for the number of establishments, is above 50 per cent.

TABLE 128.—*Compressed and liquefied gases—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	46	30	16	53.3
Capital	$6,943,805	$2,117,355	$4,826,450	227.9
Salaried officials, clerks, etc., number	243	101	142	140.6
Salaries	$258,555	$121,912	$136,643	112.1
Wage-earners, average number	426	211	215	101.9
Total wages	$271,392	$149,986	$121,406	80.9
Miscellaneous expenses	$451,712	$160,561	$291,151	181.3
Cost of materials used	$1,117,930	$636,519	$481,411	75.6
Value of products	$2,673,846	$1,320,042	$1,353,804	102.6

The statistics of Table 129 show an increase for 1905 over 1900 for every item enumerated at both censuses except for the quantity and value of aqua ammonia, the quantity of calcined magnesia, and the value of all other gases. The largest increase in value, $738,697, is in the item of anhydrous ammonia, and the second largest increase, $624,603, in that of carbon dioxide, while the largest percentages of increase in value, 232.2 per cent and 168.6 per cent, respectively, appear for illuminating gas and anhydrous ammonia. The largest increase in quantity, 23,907,346 pounds, is in carbon dioxide, and the second largest increase, 3,308,504 pounds, in anhydrous ammonia. The decrease in the quantity and value of the aqua ammonia produced arises from the fact that the ammonia can now be more profitably manufactured into anhydrous ammonia. The decrease in the quantity and the increase in the value of calcined magnesia appear to arise from the difference in the conditions of the market for this product in different localities, for in some places it is easier to dispose of calcined magnesia at an acceptable price, and in others to dispose of epsom salts, and this determines what final state of combination the magnesium contents of the magnesite shall be made to assume.

TABLE 129.—*Compressed and liquefied gases—quantity and value of products: 1905 and 1900.*

KIND.	1905		1900	
	Quantity.	Value.	Quantity.	Value.
Anhydrous ammonia, pounds	5,752,233	$1,176,854	2,443,729	$438,157
Aqua ammonia, pounds	[1] 1,832,038	[1] 86,909	[2] 3,216,973	[2] 122,619
Calcined magnesia, pounds	2,538,000	35,003	6,556,000	32,000
Carbon dioxide, pounds	35,991,627	1,343,967	12,084,281	719,364
Epsom salts, pounds	10,111,395	102,794	(3)	(3)
Illuminating gas, 1,000 cubic feet	197,072	983,852	60,432	296,174
Laughing gas, pounds	41,020	28,311	(4)	(4)
Lime, bushels	15,785	1,278	8,000	900
Oxygen, gallons	1,898,410	69,246	395,350	38,170
All other gases		2,957		35,106

[1] Includes 291,589 pounds, with an assigned value of $11,664, consumed in establishments where manufactured.
[2] Includes 201,503 pounds, with an estimated value of $7,254, consumed in establishments where manufactured.
[3] Not shown separately in 1900.
[4] Included in "all other gases" in 1900.

The item of illuminating gas in Table 129 illustrates the manner in which the summations of individual industries are arrived at, for this product primarily, and properly, appears in the industry classified as "gas, manufactured," but as it is compressed, the figures are again shown here in order to present as complete a view as possible of the industry of compressing and liquefying gases for sale. No data for illuminating gas are included in the statistics of Table 128, and therefore there is no duplication in the total values given for chemicals and allied products.

TABLE 130.—*Compressed and liquefied gases—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1] 72	[1] 56
Alabama	1	1
Arkansas	1	1
California	5	2
Colorado	1	
Connecticut	1	
Delaware		1
District of Columbia	1	1
Florida	1	1
Georgia	3	1
Illinois	4	4
Indiana	1	1
Iowa	1	
Kansas		1
Louisiana	2	
Maryland	1	1
Massachusetts	3	2
Michigan		1
Minnesota	5	1
Missouri	5	2
New Jersey	8	9
New York	14	10
North Carolina		1
Ohio	3	4
Oregon		1
Pennsylvania	7	6
Tennessee		2
Texas	1	
Virginia	1	
Vermont		1
Wisconsin	2	1

[1] Includes 26 establishments engaged primarily in the manufacture of other products.

The statistics of Table 130 show that New York has held the first place in rank in this industry at each census, New Jersey the second place, and Pennsylvania the third. No other state shows more than 5 establishments at either census.

TABLE 131.—*Compressed and liquefied gases—value of products, by geographic divisions: 1905 and 1900.*

DIVISION.	1905	1900
United States	[1] $3,858,628	[1] $1,732,509
North Atlantic	1,442,180	797,802
South Atlantic	322,567	201,272
North Central	1,815,106	618,378
South Central	95,159	41,934
Western	183,616	73,123

[1] Includes "all other products."

The statistics of Table 131 show a marked increase in every division enumerated, the largest increase, $1,196,728, being in the North Central division, and the second largest, $644,378, in the North Atlantic. The largest percentage of increase, 193.5 per cent, is also found for the North Central division. Measured by the value of products, the North Central division, which stood second in this industry at the census of

1900, stands first at the census of 1905, and the North Atlantic division, which stood first in 1900, now stands second.

TABLE 132.—*Compressed and liquefied gases—quantity and cost of materials used: 1905 and 1900.*

KIND.	1905		1900	
	Quantity.	Cost.	Quantity.	Cost.
Ammonia liquor, gallons [1]	10,258,764	$204,467	916,851	$16,504
Ammonium nitrate, pounds	75,894	10,890	(2)	(2)
Ammonium sulphate, pounds	6,340,661	253,543	4,186,186	106,632
Aqua ammonia, pounds	3,752,267	146,388	4,555,734	225,026
Carbonate of potash, pounds	370,124	15,780	(2)	(2)
Chlorate of potash, pounds	28,573	3,325	(2)	(2)
Lime, bushels	173,824	28,478	113,218	14,263
Limestone, tons	499	4,989	631	4,418
Magnesite, tons	111,106	71,296	134,808	55,899
Oil, gallons	3,506,614	172,146	1,385,021	57,741
Sulphuric acid, tons	8,295	91,976	4,014	46,229

[1] 16-ounce liquor. [2] Not shown separately in 1900.

The statistics presented in Table 132 show an increase in every item shown at each census except in the quantity and cost of aqua ammonia and the quantities of limestone and magnesite. The decrease in the quantity of aqua ammonia used may well be accounted for by such an increase in the quantity of ammonium sulphate and ammonia liquor used as has been reported, while the increased use of carbon dioxide from natural sources and from breweries may account for the decrease in the use of limestone and magnesite. The largest increase in cost, $187,963, is for the ammonia liquor reported, and the second largest, $146,911, for ammonium sulphate. The largest percentage of increase in cost, 1,138.9 per cent, is found for ammonia liquor, and the second largest, 198.1 per cent, for oil. The units of measure employed for the different materials reported are so many and unlike that no comparison by quantity of any value can be made.

The direct liquefaction of acetylene has failed to reach a commercial development, because of the fact that, being an endothermous compound, it is easily decomposed with explosive violence if, when under a pressure of more than 2 atmospheres, it is subjected to a shock. In common with other endothermous compounds this sensitiveness of acetylene is diminished by admixture with other substances, and it has been the custom in Germany to employ, for lighting the coaches on railroads, a mixture of 25 per cent of acetylene and 75 per cent of a gas of low candlepower made from shale, compressed in cylinders under a pressure of 150 pounds to the square inch. Advantage has also been taken of the fact that acetone is a solvent for acetylene, the volume of acetylene gas that may be so dissolved increasing once with each pound of pressure to which the gas is subjected. Containers filled with porous substances to facilitate absorption and localize dissociation, in the event of its occurrence, have met with favor in the lighting of coaches, yachts, buoys, and so on, but the statistics of acetylene compression are as yet too few to permit of separate presentation.

The increase in the quantity of anhydrous ammonia manufactured depends principally upon the extension of the compressor system of artificial refrigeration, though this substance is also employed to some extent in the absorption system. Thus, from the report on manufactured ice,[1] it appears that at the census of 1900, 946,666 pounds of anhydrous ammonia, costing $249,838, were used in the compressor system, and 109,869 pounds, costing $29,842, in the absorption system; while at the census of 1905, 1,795,893 pounds, valued at $484,769, were used in the compressor system and 136,604 pounds, costing $37,506, in the absorption system. There were therefore used in the manufacture of ice, at the census of 1900, a total of 1,056,535 pounds of anhydrous ammonia, costing $279,680, and at the census of 1905 a total of 1,932,497 pounds, costing $522,275. The manufacture of ice, however, represents but a part, and probably the lesser part, of the application of the process of artificial refrigeration, for, as is well known, it is applied very extensively in cold storage for the preservation of food products, and in many manufacturing operations. Mention has already been made of the use of ice or refrigerating machines in the manufacture of nitroglycerin. Another recent application of these machines, due to James Gayley, first vice-president of the United States Steel Corporation,[2] is in the drying of the air for use in blast furnaces used in the production of cast iron, by freezing the moisture out of the air. Many of the large establishments in which such refrigerating appliances are in use manufacture the anhydrous ammonia which they consume in their apparatus, and such manufacture, as a rule, escapes census enumeration. There is no doubt that the anhydrous ammonia produced for sale is considerably less than the entire product of a given year.

In 1905, as in 1900, carbon dioxide was obtained chiefly from the earth about mineral springs, from the fermentation tubs in breweries, from the combustion of coke, from the calcination of limestone or magnesite, and from the treatment of magnesite or other carbonates with sulphuric acid; but the proportions of the total drawn from these various sources in 1905 have changed materially from what they were in 1900. According to Minor,[3] at Saratoga Springs, N. Y., where the gas is recovered from the natural carbonated saline waters found there, over forty springs (or wells) have been drilled for gas producing purposes, and these yield about 20,000 pounds of carbon dioxide per day.

> The wells are generally 6 inches in diameter, varying in depth from 150 feet to 600 feet as they extend south. The rock is an argillaceous slate lying above limestone, and it is at the juncture of the two that the carbonated water is generally found, if at all, for many nonyielding wells have been drilled. The water as it issues from the well carrying its gas under pressure, is piped directly into

[1] Census of Manufactures, 1905, Bulletin 83, pages 54 and 55.
[2] James Gayley, "The Application of Dry Air Blast to the Manufacture of Iron," Iron and Steel Institute, 1904.
[3] John C. Minor, jr., "The Production and Modern Uses of Carbonic Acid," The Chemical Engineer, vol. 1, 1904, page 212.

a separator—a large barrel with a 2-foot trap or seal at the bottom from which the water escapes to waste, and with a pipe at the top leading to the gasometer into which the gas, following the path of least resistance, naturally discharges. The process of securing the gas is therefore purely automatic, and but little goes to waste with the water except that in actual solution.

Once stored in the gasometer the methods of treatment are quite similar for all plants. The gas is drawn through calcium chloride dryers to remove any moisture and passes on to the compressor, working generally in three stages, 60,300, and 1,000 pounds, varying a little with the temperature. After each stage the gas is thoroughly cooled, finally passing into the cylinders for shipment, the weight of gas admitted being carefully controlled.

Upon the ability to secure a steel container for shipping, of not excessive weight and capable of withstanding shocks in transit and an internal test pressure of 3,700 pounds per square inch, the future of this industry has rested. The cylinders or tubes now used are either of lap-welded or of seamless steel, the smaller size being $5\frac{9}{16}$ inches O. D., and 48 inches long with a water capacity of 30 pounds, into which 20 pounds of gas are filled, and the larger size of $8\frac{9}{16}$ inches O. D., and 51 inches long with a water capacity of 90 pounds, and filled ordinarily with 60 pounds of gas. This gives a ratio of gas to water capacity of about 67 per cent and the pressures reached under ordinary conditions are as follows:

At 60° F., 745 pounds per square inch.
80° F., 966 pounds per square inch.
110° F., 1,715 pounds per square inch.
130° F., 2,240 pounds per square inch.

The bursting pressure for the seamless tubes varies between 5,100 and 5,900 pounds, and for the lap-welded between 4,900 and 5,500 pounds, and every tube before using is tested to 3,700 pounds per square inch.

According to Fuller[1] the carbon dioxide obtained at Saratoga appears to come mainly from the Trenton limestone and to result from the action upon it of chlorinated water.

A development of the process for producing carbon dioxide from coke consists in burning the coke in a furnace with cold blast, cooling the resultant mixed gases in water-cooled tubes, scrubbing them with water in coke towers in order to remove SO_2, soot and dirt, and then passing them into a solution of a cold normal alkali carbonate, such as potassium or sodium carbonate, thereby causing the formation of an acid carbonate, commonly known as a bicarbonate. The resulting solution of the bicarbonate is then heated by the waste heat from the coke-burning furnace, whereby the carbon dioxide that has been absorbed is set free and the normal carbonate solution is regenerated for use again in the absorbing tower. A characteristic feature in the recovery of the gas from closed fermentation vats in breweries consists in passing the gas, after it has been washed, through a solution of potassium permanganate in order to oxidize and destroy the organic matters that accompany it, and impart to it an odor indicative of its origin.

The several processes in use, when properly carried out, yield a product which is from 98 to 99.5 per cent pure. A considerable number of uses to which compressed carbon dioxide is applied were enumerated in the report on chemicals and allied products at the census of 1900. Additional applications mentioned by Minor are (1) in the operation of block signals by the electro-pneumatic process, which is as follows:

When a train approaches the signal it short circuits a track battery, thereby opening a relay and closing an electrical contact point, which in turn causes an electro-pneumatic valve to open, provided there is no train on the block ahead. Carbonic acid at 54 pounds pressure is thus permitted to pass from a secondary tank, fed by a gas cylinder through a pressure regulator, to the semaphore casting which when forced up by the pressure causes the blade to go from a horizontal or stop position to one of 60°, thus giving a proceed signal to the train.

And (2) in the treatment of logwood:

In the ordinary methods of extraction there is a partial decomposition of the coloring matter into products which can not afterwards be separated from it. These have a most detrimental effect on the efficiency of the product as a dye. By extraction in the presence of CO_2, not only is there a definite compound—hematoxylin carbonate—formed, but the decomposition is prevented which occurs when the color is extracted by any other process. When dyed upon cotton, with an alkaline bath, the glucose contained in the extract made by other methods reduces the copper salt to red oxide, which is precipitated with the color as an insoluble lake, having no affinity for cotton fiber and producing the so-called "dusty" condition. The new product does not reduce copper salts and does produce even and perfect shades of color on the fiber.

The compression of illuminating gas has long been practised, and it was in the examination of the liquid deposited from this compressed gas that Faraday, in 1825, discovered the very important hydrocarbon known as benzene. This very deposition of the heavier hydrocarbon in the gas, however, impoverished the gas and rendered it less fit for use as an illuminant. The great convenience that often results from being able to store gas in portable cylinders and to use it at will is obvious, and this fact has served to stimulate inventors to continued efforts, until success was reached in processes such as that of Pintsch or of Peebles, in which the gas is made by "cracking" certain petroleum, tar, or shale oils in retorts, and then compressing them in cylinders under low pressures. Since this oil gas is rich in benzene and olefiant hydrocarbons, it must be burned in specially designed burners. By admixture with a certain amount of oxygen its combustibility and illuminating powers are improved. In its formation tar and liquid hydrocarbons are obtained as by-products. Compressed illuminating gas is principally used in lighting railway coaches and buoys, although some, obtained by compressing ordinary city gas, is used in the oxyhydrogen lamp with magic lanterns, and is sold under the name of hydrogen, or black gas, the latter name referring to the color of the cylinders in which it is stored.

Liquid hydrogen has not yet appeared in commerce, although the process of liquefying it was exemplified on a large scale in the British Government Exhibit at the Louisiana Purchase Exposition at St. Louis. Compressed hydrogen is utilized in the Clowes lamp employed in detecting the presence of dangerous gases in mines, the holds of ships, and other inclosed places. A recent important industrial use for it, or for com-

[1] Myron L. Fuller, "Carbon Dioxide," Mineral Resources of the United States, 1905, page 1259.

pressed acetylene, is found in the compound blowpipes used in cutting or perforating metals, which enable one to cut into pieces with ease and celerity large masses of iron, steel, or other metals. A competitor to compressed hydrogen is found in the generators making use of metallic hydrides, such as lithium or calcium hydrides, for these substances on contact with water react with it in a manner similar to that of calcium carbide; hydrogen gas is thus set free, and may, if desired, be evolved under pressure. The calcium hydride proposed for this use has been commercially styled hydrolith.

Not much progress seems to have been made in the commercial development of liquid air, though the processes for its production have been greatly improved. This seems to be due to the fact that the demand for it has been limited to the use of a portion of the oxygen obtained from it for medical purposes, and to the use of a still smaller quantity of the liquid air itself for popular demonstrations or scientific researches. As about four-fifths of the atmospheric air is nitrogen, and as there has been in the past no commercial use for nitrogen, the entire cost of production has had to be borne by the oxygen which was sold as such. Mention has been previously made in these pages of the recent utilization of nitrogen in the manufacture of calcium cyanamid, and this application will probably give a marked impetus in the near future to the manufacture of liquid air.

Class XVIII.—Fine Chemicals.

This class embraces those chemicals sold in the trade as chemically pure or absolutely pure; the chemicals which are more especially made use of in analytical operations, in scientific research, and in pharmacy; and those chemicals for which, like the salts of gold and of silver, the price per unit is relatively very high. Among the chemicals which are embraced here may be named all chemically pure or "analyzed" acids, bases, and salts; acetone and other ketones; absolute alcohols and all alcohols other than commercial grain and wood alcohols; aldehydes; alkaloids; elementary substances, other than common and low-priced ones; enzymes, ferments, or diastases, such as pancreatin, pepsin, rennet, trypsin, lactose, sucrose, and zymose; esters (ethereal salts or compound ethers); ethers, simple and mixed; rare earth compounds, such as the salts of cerium, lanthanum, thorium, radium, and uranium; terpenes; toxins and antitoxins; and urea and the ureides. In his recent catalogue, Schuchardt[1] enumerates upward of 6,700 different substances that he offers for sale, most of which belong in this class, and yet this list does not include all of this class of substances that are now known.

[1] Dr. Theodor Schuchardt, Chemische Fabrike, Goerlitz, No. 68, October, 1907.

Table 133.—*Fine chemicals—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	Census. 1905	Census. 1900	Increase.	Per cent of increase.
Number of establishments	43	29	14	48.3
Capital	$13,347,431	$8,029,764	$5,317,667	66.2
Salaried officials, clerks, etc., number	339	147	192	130.6
Salaries	$578,696	$220,724	$357,972	162.2
Wage-earners, average number	1,996	1,091	905	83.0
Total wages	$1,092,473	$542,865	$549,608	101.2
Miscellaneous expenses	$1,186,230	$182,815	$1,003,415	548.9
Cost of materials used	$9,629,567	$3,271,388	$6,358,179	194.4
Value of products	$13,566,955	$5,461,513	$8,105,442	148.4

The census of 1905 shows an increase in every item presented as compared with 1900, the value of products showing the substantial gain of $8,105,442, or 148.4 per cent, while the cost of materials reported increased $6,358,179, nearly trebling. The largest proportional increase, 548.9 per cent, was reported for miscellaneous expenses, and the next largest, 194.4 per cent, for cost of materials.

Table 134.—*Fine chemicals—quantity and value of products: 1905 and 1900.*

Kind.	1905 Quantity.	1905 Value.	1900 Quantity.	1900 Value.
Acetone, pounds	[1] 1,589,215	$195,978	1,638,715	$178,666
Acids, C. P., pounds	[2] 6,540,689	218,518	2,480,575	136,105
Alkaloids, ounces	5,797,925	3,229,527	4,054,478	1,750,503
Ammonia, C. P., pounds	(3)	(3)	254,952	18,131
Bromides, pounds	403,997	157,848	314,399	89,319
Camphor, refined and artificial, pounds	1,166,372	722,907	598,708	254,190
Chloroform, pounds	616,670	165,604	(4)	(4)
Esters, pounds	403,260	187,680	785,300	118,725
Ether, pounds	[5] 4,239,174	2,243,965	[6] 1,485,942	741,228
Fusel oil, refined, pounds	[7] 2,077,600	355,417	(4)	(4)
Gold salts, ounces	47,641	453,202	12,347	120,696
Iodides, pounds	84,702	211,619	20,714	32,831
Pepsin, pounds	(3)	(3)	19,030	76,120
Platinum salts, ounces	(3)	(3)	8,112	61,400
Rare earth salts, pounds	[8] 90,558	406,326	5,373	25,550
Silver salts, ounces	1,899,081	778,439	1,606,108	627,252
Vanillin, ounces	579,877	165,044	124,874	113,050

[1] Includes 288,820 pounds, with an assigned value of $34,658, consumed in establishments where manufactured.
[2] Includes 14,661 pounds, with an assigned value of $1,026, consumed in establishments where manufactured.
[3] Not shown for 1905.
[4] Not shown for 1900.
[5] Includes 3,384,763 pounds, with an assigned value of $1,816,564, consumed in establishments where manufactured.
[6] Includes 1,222,704 pounds, with an assigned value of $611,352, consumed in establishments where manufactured.
[7] Includes 925,935 pounds, with an assigned value of $143,417, consumed in establishments where manufactured.
[8] Includes 45,939 pounds, with an assigned value of $183,756, consumed in establishments where manufactured.

The statistics of Table 134 show an increase in every item presented at both censuses except in the quantities of acetone and of esters. As the change in the specifications for the smokeless powder used by the United States Army, from a nitroglycerin-nitrocellulose base to a nitrocellulose base only, necessitated the abandonment of acetone and the adoption of ether-alcohol as the colloidizing agent, there has been as a consequence a reduction in the amount of acetone used notwithstanding the fact that an increase in its use for the manufacture of chloroform has

occurred at the same time. The decrease in the quantity of esters produced together with the increase in value of the product shows that the falling off is only in the lowest priced of these products.

The largest total increase in quantity, 4,060,114 pounds, is found in the item of chemically pure acids. The second largest increase, 2,753,232 pounds, is found in the item of ether, but this includes also the ether that is consumed in further manufacture in the establishment where it was produced, the major portion of this last-mentioned ether having been both produced and consumed in explosives works in the manufacture of smokeless powder. The largest increase in value, $1,502,737, appears in the item of ether, but this includes the estimated value of that which was consumed in the establishment where it was produced. Ether shows also a marked increase in the value of the unit. The second largest increase in value, $1,479,024, is found in the item of alkaloids. It will be observed that the number of different products shown in Table 134 is relatively small. This is due partly to the fact that under Census rules statistics can not be presented separately unless there are at least 3 establishments, operating independently, for which such statistics have been obtained; partly to the fact that the fine chemicals made by pharmaceutical manufacturers and the enzymes and ferments produced for sale in zymotechnic laboratories are included, on account of the principal products of the establishments manufacturing them or the uses to which these products are put, in the products of other industries; and partly to the fact that manufacturers frequently fail to make reports in detail. Nevertheless, Schuchardt's catalogue indicates that the manufacture of fine chemicals, and especially of the modern synthetic preparations, is controlled by the German chemical manufacturers. But a small proportion of the fine chemicals that Schuchardt enumerates appear to be manufactured in this country at all, and, judging by the census returns, fewer still are manufactured for sale. The fine chemicals presented in Table 134 named on the schedules which were received at the censuses and which, under the rules, could not be set forth separately, are the elements gold, iodine (resublimed), nickel (purified), phosphorus, and silver; compounds of antimony, magnesium, manganese, mercury, nickel, and titanium; and the organic compounds acetic anhydride, acetanilide, benzaldehyde, formaldehyde, glycosine, paraformaldehyde, phenalgin, resorcin, saccharin, salol, and synthetic perfumery bases.

TABLE 135.—*Fine chemicals—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1]67	[2]49
California	1	1
Colorado	1	1
Indiana	......	1
Illinois	1	2
Maryland	1	1
Massachusetts	2	1
Michigan	3	1
Missouri	4	2
Nebraska	......	1
New Jersey	23	15
New York	14	7
Ohio	3	2
Pennsylvania	11	13
Rhode Island	1	1
Virginia	1	......
Wisconsin	1	......

[1] Includes 24 establishments engaged primarily in the manufacture of other products.
[2] Includes 20 establishments engaged primarily in the manufacture of other products.

The statistics of Table 135 show that there has been a gain of 18 in the number of establishments engaged in the manufacture of fine chemicals at the census of 1905 as compared with 1900, the largest increase in number, 8, being for New Jersey, and the second largest increase, 7, being for New York. At each census New Jersey has ranked first in the number of establishments, reporting in 1905, 34.3 per cent, or over one-third of the total. At the census of 1905 New York, which ranked third at the census of 1900, stood second, exchanging places with Pennsylvania. No other state reported as many as 5 establishments at either census.

TABLE 136.—*Fine chemicals—value of products, by geographic divisions: 1905 and 1900.*

DIVISION.	1905	1900
United States	[1]$14,235,937	[1]$6,272,289
North Atlantic and South Atlantic	11,892,640	5,594,756
North Central and Western	2,343,297	677,533

[1] Includes "all other products."

It will be observed that the industry was practically confined to the North Atlantic and South Atlantic divisions, these two divisions together reporting 89.2 per cent of the total value of products in 1900 and 83.5 per cent of the total in 1905. As a matter of fact the industry is concentrated chiefly in the North Atlantic division, there being but 2 establishments in the South Atlantic division, and may properly be regarded as reaching its highest development in the older communities. The largest proportional increase, 245.9 per cent, was reported for the North Central and Western divisions combined, against a gain of 112.6

per cent in the North and South Atlantic divisions combined, although the absolute increase in the latter divisions exceeded that in the former by $4,632,120.

TABLE 137.—*Fine chemicals—quantity and cost of materials used: 1905 and 1900.*

KIND.	1905		1900	
	Quantity.	Cost.	Quantity.	Cost.
Acetate of lime, tons	3,553	$108,779	4,232	$130,596
Alcohol, gallons	1,239,708	678,326	219,603	265,477
Caustic soda, tons	80	3,793	(1)	(1)
Crude drugs, pounds	14,444,950	2,388,429	4,330,254	849,894
Fusel oil, gallons	466,632	408,612	192,153	92,269
Gold, troy ounces	18,963	391,248	6,780	136,554
Monazite, pounds	491,132	45,244	(1)	(1)
Muriatic acid, pounds	1,181,078	11,877	1,146,697	14,089
Nitric acid, pounds	1,505,870	74,516	183,667	11,081
Platinum, ounces	(1)	(1)	3,488	61,215
Silver, ounces	996,582	559,556	954,196	562,095
Sulphuric acid, tons	2,249	36,299	1,640	10,432

[1] Not shown separately.

The statistics of Table 137 show an increase in every item presented at each census, except in the quantity and cost of acetate of lime and the cost of muriatic acid and silver. Acetate of lime is used for the manufacture of acetone, and the decrease reported for the former is quite in harmony with the decrease shown in Table 134 for the latter. The decrease shown for muriatic acid apparently arises from the more extended use of the cheaper quality of acid. The largest increase in quantity, 10,114,696 pounds, is for crude drugs, and the second largest increase in quantity, 1,322,203 pounds, is for nitric acid. The largest increase in cost, $1,538,535, is shown for crude drugs, and the second largest increase in cost, $412,849, for alcohol.

Although acetone is no longer employed, in this country at least, in the manufacture of smokeless powder, new uses are being found for this as for other chemical substances. At the last census attention was called to the fact that this substance is used largely as a substitute for grain alcohol in the manufacture of chloroform. It is now found to be of value also in the developing of negatives in photography.

An important group of bodies in this class is that of C. P. chemicals. This designation has long been used in the art, and among consumers has been presumed to signify that the material so designated was chemically pure. But the results of the examinations of many samples of materials so labeled on the market have led to the conclusion that in many instances the abbreviations represent comparatively pure, or commercially pure. The importance of having for use, especially in analytical chemistry, and very frequently in other chemical operations, chemicals of assured purity led the Association of Official Agricultural Chemists and the American Chemical Society to advocate the establishment by the United States Government of a Bureau of Standards, by which the materials offered on the market could be tested and the instruments employed in the profession could be standardized, and such a bureau has been formed. Not content with this, however, the American Chemical Society has maintained for several years past a committee on quality of reagents, with the result that manufacturers are now offering what are known as "analyzed chemicals," because the label bears a record of the analysis, showing the kind and quantity of foreign bodies which are present in the material sold. In fact, the interval since the last census has been marked by a steady progress in the direction of making the label set forth the true character of the goods to which it is applied.

An interesting development is found in the production of camphor by a synthetic process from turpentine. A terpene hydrochloride has been known for some time and used under the name of artificial camphor, but by the process in which anhydrous turpentine is heated with an anhydrous oxalic acid, and the mixture treated with caustic alkali and steam, true synthetic camphor appears to be formed. Unfortunately the operation does not appear thus far to have been commercially successful, but it is believed that it may become so if carried on in the turpentine producing region instead of remote from it, as has thus far been the case.

Another interesting development of recent years is found in the manufacture of chloroform. At the last census it was pointed out that acetone had come to be used on a considerable scale in this manufacture. In the discussion of Class X of the present report attention has been called to the fact that carbon tetrachloride has come to be made in large quantities in connection with this industry. It now appears that a use has been found for this carbon tetrachloride in the manufacture of chloroform by reverse substitution, that is, by replacing one of the chlorine atoms in the carbon tetrachloride molecule by an atom of hydrogen, and that this promises to be successful commercially.

Another is found in the successful commercial development in this country of the invention of P. Fritzsche, for which United States letters patent 475640, of January 19, 1897, were granted, and by which ether is produced from the ethylene occurring in illuminating and other hydrocarbon gases.

Table 138 shows the quantity and value of the imports for consumption, for the years ending June 30, from 1891 to 1905, as taken from Commerce and Navigation of the United States, published by the Bureau of Statistics.

TABLE 138.—FINE CHEMICALS—IMPORTS FOR CONSUMPTION: 1891 TO 1905.

YEAR ENDING JUNE 30—	ACONITE BARK, LEAF, AND ROOT.		NUX VOMICA.		ALL SALTS OF MORPHIA OR MORPHINE.		MORPHIA OR MORPHINE, SULPHATE OF, AND ALL ALKALOIDS OR SALTS OF OPIUM.		STRYCHNIA, STRYCHNINE, AND SALTS OF.		ETHERS. Sulphuric.		ETHERS. Other, not specially provided for.		ETHERS. All on which specific duty does not amount to 25 per cent (value).	ETHERS. Nitrous, spirits of.	
	Pounds.	Value.	Pounds.	Value.	Ounces.	Value.	Pounds.	Value.	Ounces.	Value.	Pounds.	Value.	Pounds.	Value.		Pounds.	Value.
1891	2,761	$266	1,394,013	$32,930	29,564	$42,269	......	......	230	$175	8	$1	981	$1,702	......	......	......
1892	......	......	1,392,437	34,038	38,758	43,301	......	......	305	153	101	28	689	2,093	......	......	......
1893	4,351	236	1,720,315	41,567	23,580	25,035	......	......	16,538	7,053	20	2	730	2,033	......	......	......
1894	1,329	108	1,720,056	39,821	29,076	36,452	......	......	566	259	145	32	584	1,781	......	......	......
1895	......	......	595,497	9,620	16,029	18,507	......	......	1,158	502	55	5	744	2,281	......	17	$7
1896	3,034	197	1,275,500	15,668	896	1,083	......	......	8,766	3,405	191	24	1,463	7,125	......	......	......
1897	4,020	620	1,298,637	15,200	14,949	30,301	......	......	1,377	578	466	44	2,376	9,158	......	......	......
1898	......	......	2,026,465	29,529	2,382	2,832	13,409	$32,836	13,049	6,381	476	103	3,276	5,781	$4,323	......	......
1899	1,392	120	1,636,152	28,995	......	......	13,081	35,357	15,394	6,570	187	35	2,291	3,669	1,457	......	......
1900	3,808	274	3,070,536	65,460	......	......	26,208	75,274	7,753	3,362	817	110	2,573	4,507	1,461	......	......
1901	1,130	113	1,581,757	30,560	......	......	50,819	147,517	4,732	1,921	109	30	2,464	4,769	1,364	......	......
1902	2,066	138	2,876,318	47,856	......	......	38,002	96,559	687	297	940	135	2,117	4,090	1,610	22	10
1903	8,598	600	2,463,340	36,800	......	......	12,371	25,717	372	249	2,003	325	2,286	4,739	1,615	105	27
1904	2,800	295	3,139,211	47,449	......	......	20,763	43,766	5,138	2,033	1,530	259	2,313	4,686	2,360	10	1
1905	2,418	153	2,798,814	47,049	......	......	21,391	41,734	738	433	897	165	3,479	6,600	3,485	......	......

YEAR ENDING JUNE 30—	ALKALOIDS OR SALTS OF CINCHONA BARK. Bark or other materials from which quinine may be extracted.		ALKALOIDS OR SALTS OF CINCHONA BARK. Cinchonidia.		ALKALOIDS OR SALTS OF CINCHONA BARK. Sulphate of quinia.		ALKALOIDS OR SALTS OF CINCHONA BARK. All other.		PHOSPHORUS.		BROMINE.	
	Pounds.	Value.	Ounces.	Value.	Ounces.	Value.	Ounces.	Value.	Pounds.	Value.	Pounds.	Value.
1891	2,672,364	$301,085	156,229	$3,856	3,079,000	$805,821	112,013	$23,977	151,166	$53,590	......	......
1892	3,423,941	299,998	11,483	1,586	2,686,677	542,440	156,442	29,366	85,622	31,643	53,563	$7,094
1893	2,374,041	196,867	364,192	11,714	3,027,819	556,782	48,030	11,695	89,874	44,068	780	234
1894	2,502,224	143,194	313,640	7,177	2,141,130	470,816	40,850	10,991	20,757	11,927	20	11
1895	2,012,399	117,998	72,425	3,534	1,308,959	327,541	37,027	10,857	28,747	14,131	......	......
1896	2,699,789	165,699	282,321	9,980	2,950,078	754,050	76,507	23,147	50,027	26,646	......	......
1897	......	......	......	......	2,714,147	489,821	367,373	57,237	60,731	29,870	......	......
1898	......	......	303,278	38,802	3,643,298	752,211	424,665	106,961	43,351	21,849	......	......
1899	......	......	233,885	34,932	2,788,663	665,819	985,480	252,141	12,399	7,366	......	......
1900	......	......	101,335	15,924	2,628,060	763,986	515,168	155,817	25,228	9,789	......	......
1901	4,196,419	781,895	28,000	9,465	3,495,996	1,078,472	817,315	289,630	38,315	15,125	......	......
1902	3,660,718	617,716	18,000	6,695	2,358,159	641,459	629,735	200,162	32,965	12,869	......	......
1903	3,980,072	547,332	44,000	9,524	2,534,106	576,404	796,338	168,370	23,986	10,229	......	......
1904	3,605,131	501,375	89,110	25,395	3,059,514	659,868	736,625	166,923	21,009	9,671	......	......
1905	4,353,439	596,614	44,580	6,651	2,264,454	504,351	639,823	134,404	19,397	8,554	......	......

YEAR ENDING JUNE 30—	IODINE. Crude.		IODINE. Crude and resublimed.		IODINE. Resublimed.		CHLORAL HYDRATE.		CHLOROFORM.		IODOFORM.		HYDRIODATE, IODIDE, AND IODATE OF POTASH.		CALOMEL, AND OTHER MERCURIAL MEDICINAL PREPARATIONS.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1891	241,186	$382,009	......	......	35	$106	......	......	......	......	1,242	$19,459	1,024	$935	7,801	$5,244
1892	164,185	167,893	......	......	4	14	......	......	35	$15	244	890	186	505	12,630	8,114
1893	327,248	589,186	......	......	6	25	......	......	11	14	175	649	187	475	13,495	7,941
1894	401,501	587,127	......	......	7	31	......	......	43	18	103	382	181	464	8,435	4,715
1895	......	......	31,374	$48,350	......	......	20,097	$10,976	239	164	158	583	235	561	8,280	4,209
1896	......	......	291,895	566,908	......	......	30,275	17,367	137	46	243	926	5,489	9,289	13,900	7,154
1897	......	......	391,551	872,526	......	......	63,360	35,138	91	18	115	437	2,774	5,032	12,349	6,053
1898	401,214	805,783	......	......	22	53	40,263	23,063	542	123	30	96	280	649	12,316	6,386
1899	315,476	573,469	......	......	43	146	12,370	7,562	227	72	52	163	2,168	3,607	21,963	11,848
1900	573,128	1,452,434	......	......	501	1,410	795	1,534	75	36	202	602	1,288	2,155	16,647	10,163
1901	262,052	658,492	......	......	22	21	4,485	2,993	259	79	21	93	663	1,328	26,933	15,931
1902	316,786	819,272	......	......	116	219	26,977	8,793	1,885	611	154	313	1,654	3,346	22,449	13,606
1903	284,895	785,220	......	......	75	176	18,144	6,252	742	357	72	192	920	1,624	23,570	14,063
1904	418,163	955,702	......	......	63	138	8,733	2,416	2,203	616	65	187	1,093	2,129	28,623	16,566
1905	350,830	699,659	......	......	31	91	......	......	826	293	68	246	891	2,093	26,076	14,137

CLASS XIX.—GENERAL CHEMICALS.

This class embraces all chemicals not enumerated in any of the classes previously considered. In commerce the term "general chemicals" includes also acids, sodas, potashes, alums, acetate of lime, and many other chemicals for which the statistics have been given in the previous sections of this report. These chemicals have a low unit value and are usually sold in ton lots, for which reason they are also designated as heavy chemicals.

The statistics of Table 139 show an increase in every item except the number of establishments. The large increases were reported of $5,751,140 in value of products and of $3,356,028 in cost of materials. The greatest proportional increase is shown in miscellaneous expenses and the next greatest in the item of salaries.

TABLE 139.—*General chemicals—comparative summary, with amount and per cent of increase: 1905 and 1900.*

	CENSUS.		Increase.	Per cent of increase.
	1905	1900		
Number of establishments	74	97	[1] 23	[1] 23.7
Capital	$14,986,703	$12,433,065	$2,553,638	20.5
Salaried officials, clerks, etc., number	660	365	295	80.8
Salaries	$1,001,955	$550,748	$451,207	81.9
Wage-earners, average number	3,720	2,402	1,318	54.9
Total wages	$2,072,341	$1,245,426	$826,915	66.4
Miscellaneous expenses	$1,512,842	$829,205	$683,637	82.4
Cost of materials used	$12,646,513	$9,290,485	$3,356,028	36.1
Value of products	$18,874,897	$13,123,757	$5,751,140	43.8

[1] Decrease.

Table 140 shows an increase for 1905 as compared with 1900 for each item given at both censuses, except in the quantity of acetate of lead, the quantity and value of aqua ammonia, the quantity and value of copperas, the quantity and value of Glauber's salt, the quantity of salt cake, and the value of zinc salts. The largest increase in quantity, 95,113 tons, or 2,686.8 per cent, is found in the item of calcium chloride, and the second largest increase in quantity, 19,740 tons, is found in the item of niter cake, but the second largest proportional increase in quantity, 368.4 per cent, is found in the item of ammonium nitrate. The largest increase in value, $774,859, is shown in the item for cream of tartar, and the second largest, $757,362, is for the item tin compounds. The largest proportional increase in value, however, 807.4 per cent, appears for the item of calcium chloride, and the second largest increase, 580.9 per cent, for ammonium nitrate.

TABLE 140.—*General chemicals—quantity and value of products: 1905 and 1900.*

KIND.	1905		1900	
	Quantity.	Value.	Quantity.	Value.
Acetate of lead, pounds	[1] 1,202,383	$78,619	1,296,991	$73,220
Aqua ammonia, pounds	[2] 22,485,732	1,010,723	[3] 25,089,116	1,023,528
Ammonium nitrate, pounds	[4] 3,253,061	521,373	[5] 694,438	76,571
Calcium chloride, tons	98,653	257,311	3,540	28,357
Copperas, pounds	9,700,104	28,096	27,595,909	199,869
Cream of tartar, pounds	15,650,000	2,892,563	10,981,680	2,117,704
Epsom salts, pounds	20,566,443	215,088	9,239,809	75,066
Glauber's salt, pounds	14,665,456	103,392	32,659,907	163,059
Glycerin, pounds	19,311,997	2,397,205	15,383,778	1,893,886
Niter cake, tons	[6] 35,221	87,792	[7] 15,481	46,358
Phosphates of soda, pounds	9,659,519	244,373	4,679,160	155,989
Salt cake, tons	[8] 38,244	417,173	[9] 48,296	399,347
Saltpeter, tons	7,234	596,689	[10] 6,136	487,987
Tin compounds, pounds	11,621,378	1,361,299	6,259,794	603,937
Zinc salts, pounds	11,579,546	201,771	9,511,909	353,900

[1] Includes 91,500 pounds, with an assigned value of $8,235, consumed in establishments where manufactured.
[2] Includes 3,419,978 pounds, with an assigned value of $170,999, consumed in establishments where manufactured.
[3] Includes 275,080 pounds, with an assigned value of $9,902, consumed in establishments where manufactured.
[4] Includes 2,671,564 pounds, with an assigned value of $427,450, consumed in establishments where manufactured.
[5] Includes 657,758 pounds, with an assigned value of $72,353, consumed in establishments where manufactured.
[6] Includes 6,240 tons, with an assigned value of $15,600, consumed in establishments where manufactured.
[7] Includes 3,746 tons, with an assigned value of $11,238, consumed in establishments where manufactured.
[8] Includes 2,088 tons, with an assigned value of $25,056, consumed in establishments where manufactured.
[9] Includes 6,185 tons, with an assigned value of $51,026, consumed in establishments where manufactured.
[10] Includes 849 tons, with an assigned value of $67,071, consumed in establishments where manufactured.

Attention was called, in the report on this class at the census of 1900,[1] to the incompleteness of the statistics for general chemicals. The returns for 1905 were, if possible, even less detailed, so that fewer items can be presented. Two substances which are of especial economic interest in this connection, but which could not well be included in the tabular presentation, are ammonium sulphate and ammonia liquor. A small quantity of ammonium sulphate is reported as being produced in establishments included in the classification of chemicals and allied products, but the larger part of the ammonium sulphate manufactured and all of the ammonia liquor are reported from by-product coke and gas manufacturing plants. In 1900 there were reported from these sources 23,295,485 pounds of ammonium sulphate, having a value of $623,537, and, in addition, 1,681,700 pounds which were produced in the establishments where they were consumed. In 1905 there were reported produced 34,568,000 pounds of ammonium sulphate, having a value of $907,667. Ammonia liquor is produced and reported in so many different grades, or, as they are called in commerce, "strengths," that a proper comparison of the data at different periods can be made only after all such data have been reduced to a common basis, and, as in the reports from coal gas establishments, the largest number reported liquor of 16-ounce strength, this grade has been taken as a basis and all other grades reduced to it. From various data it is estimated for the census of 1900 that there were produced 28,542,800 gallons of ammonia liquor of 16-ounce strength, to which no value was assigned. For 1905 there were produced in the coke industry 40,173,210 gallons, reduced to 16-ounce strength, valued at $763,291, and in the gas industry 37,854,199 gallons, valued at $537,903. The total production of 16-ounce ammonia liquor at the census of 1905 was therefore 78,027,409 gallons, valued at $1,301,194. Another item of importance is glycerin, 27,660,661 pounds, with a value of $2,958,115, having been reported at the census of 1905 as being produced in the soap industry.[2] Combined with the glycerin reported in chemicals and allied products, the total production for 1905 is 46,972,658 pounds, having a value of $5,355,320. At the census of 1900 there were reported from other sources 11,128,676 pounds of glycerin, having a value of $1,202,715, which, combined with that shown for 1900 in Table 140, gives a total for that census of 26,512,454 pounds, valued at $3,096,601.

The statistics of Table 141 show a gain of 13 establishments in the United States total for 1905 as compared with 1900, and indicate that the decrease of 23 establishments, shown in the United States in Table 139, is wholly or partly due to such a change in the proportion of the different products of establishments at the two censuses, that establishments which were

[1] Twelfth Census, Bulletin No. 210, page 93.
[2] Census of Manufactures, 1905, Bulletin 57, page 44.

classified in Class XIX at the census of 1900 have been transferred to other classes at the census of 1905. Considering the individual states, it will be observed that New York has advanced from second to first place in rank and Pennsylvania from third to second place, while New Jersey dropped from first place in 1900 to third in 1905. California has advanced from fifth to fourth place in rank, sharing that place with Ohio.

TABLE 141.—*General chemicals—number of establishments, by states: 1905 and 1900.*

STATE.	1905	1900
United States	[1] 165	[2] 152
Alabama	2	......
California	11	11
Colorado	2	1
Connecticut	......	2
District of Columbia	1	1
Delaware	1	2
Georgia	2	......
Illinois	9	9
Indiana	3	5
Kentucky	1	1
Louisiana	2	1
Maryland	5	8
Massachusetts	8	8
Michigan	8	5
Missouri	6	3
Nebraska	......	1
New Jersey	26	28
New York	34	26
Ohio	11	12
Pennsylvania	27	24
Rhode Island	4	2
Tennessee	......	1
Vermont	1	......
Virginia	1	......
West Virginia	......	1

[1] Includes 91 establishments engaged primarily in the manufacture of other products.
[2] Includes 55 establishments engaged primarily in the manufacture of other products.

The statistics of Table 142 show an increase in the value of the products for 1905 as compared with 1900 for each division except the Western, in which there has been a decrease, the greatest increase, $3,672,463, being found in the North Atlantic division, and the second greatest increase, $1,496,588, in the North Central. At each census, measured by the value of its products, the North Atlantic division has stood first, reporting 67.8 per cent of the total in 1900 and 68.4 per cent in 1905, almost exactly two-thirds in each case. The North Central division stood second at both censuses, the South Atlantic third, the Western fourth, and the South Central fifth.

TABLE 142.—*General chemicals—value of products, by geographic divisions: 1905 and 1900.*

DIVISION.	1905	1900
United States	[1] $22,431,792	[1] $17,234,087
North Atlantic	15,351,853	11,679,390
South Atlantic	1,246,775	1,052,082
North Central	5,330,269	3,833,681
South Central	29,903	22,200
Western	472,992	646,734

[1] Includes "all other products."

The statistics of Table 143 show many irregularities, growing largely out of the fact that many of the chemicals belonging to this class are produced in establishments in which a large variety of substances is manufactured, and where in consequence the labor of making out a complete detailed return is regarded as burdensome, while others are subordinate products, so that they, as well as the materials from which they are produced, may be overlooked in the preparation of the returns. The degree in which these factors affect the returns will, of course, vary at different censuses. An effort is made in the inspection of the individual returns to remedy these defects, but this meets with only partial success. Moreover, it is not possible to reduce all grades of materials to a common standard of strength, and hence it may occur, as for instance in the case of the ammonia, or gas, liquor in Table 143, that a much larger volume at a less cost may be reported as used at one census than at another, because that reported at the former census was of lower grade.

TABLE 143.—*General chemicals—quantity and cost of principal materials used: 1905 and 1900.*

KIND.	1905		1900	
	Quantity.	Cost.	Quantity.	Cost.
Ammonia, aqua, pounds	7,246,642	$333,210	6,242,934	$270,373
Ammonia liquor, gallons	23,466,749	468,647	32,512,758	590,423
Argols, tartar and lees, tons	15,797	2,478,562	24,057	2,256,271
Bones and boneblack, tons	30,379	489,419	18,591	397,131
Brine, gallons	256,478	703,137	(1)	(1)
Glycerin, crude, pounds	21,482,084	1,933,254	15,473,126	1,302,642
Lime, bushels	569,040	80,333	164,977	25,736
Magnesite, tons	6,196	47,468	(1)	(1)
Muriatic acid, pounds	13,096,827	108,360	3,488,000	24,563
Nitrate of soda, tons	38,048	1,505,881	35,990	1,189,515
Nitric acid, pounds	4,256,111	210,163	353,014	10,629
Phosphate rock, tons	5,663	33,465	4,584	31,671
Pig lead, tons	634	60,460	257	22,668
Potassium salts, tons	11,470	512,099	9,361	278,413
Salt, tons	28,062	151,418	31,803	219,656
Soda ash, tons	14,946	283,458	7,923	122,356
Sulphur, tons	14,438	297,943	14,292	303,535
Sulphuric acid, tons	63,147	624,604	39,316	170,100
Tin, pounds	7,032,993	876,208	10,791,177	413,157
Zinc and zinc dross, pounds	5,768,186	121,412	6,048,000	163,003

[1] Not shown separately.

The marked increase in the quantity of calcium chloride reported as produced deserves attention. This increase is partly fictitious, for, as stated in the report for that census,[1] the quantity returned in 1900 was probably less than that actually produced. On the other hand, there has been, no doubt, a real increase during the interval, for this substance has come to be used extensively in automobiles, while its use in making nonfreezable solutions for fire buckets and automatic sprinkler systems, for brine and ice machines and refrigerating plants, for drying the gases in the manufacture of liquefied carbon dioxide and anhydrous ammonia, and in drying the air in compressed air power plants and of cold storage warehouses, for the manufacture of dry colors or lakes, in tempering steel, and in forming high boiling point solutions for use in such industries as the canning of foods, has been more marked. Calcium chloride is met with in the market as a solid containing 75 per cent of anhydrous calcium chloride, 24 per cent of water, and 1 per cent of foreign bodies; as a solution

[1] Twelfth Census, Bulletin No. 210, page 95.

containing from 40 to 50 per cent of anhydrous calcium chloride; and as a solution of calcium chloride and sodium bicarbonate for use in the extinction of fires. The solid material is offered in 635-pound iron drums and in 10-pound tins. The solution is offered in 4,500-gallon tank cars, in 110-gallon drums, and in 2-gallon cans.

Equally of interest is the decrease in the quantity and value of the copperas, green vitriol, or crystallized ferrous sulphate reported, since, as pointed out in the report for 1900,[1] this substance is a by-product in the pickling of iron and steel, and is used in the manufacture of venetian red and other iron pigments; in making dye liquors, prussian blue, and writing inks; for disinfecting purposes; and for the precipitation of gold from its solutions. In addition it has in recent years come to be used as a substitute for alum in the purification of service waters. The Quincy process, so called from its development at Quincy, Ill.,[2] "involves the use of ferrous sulphate and lime water, applied separately in small quantities in solution to the raw water to coagulate it, with subsequent sedimentation of the coagulated water and final rapid filtration." It is probable, in view of this new use, added to the fact that the industries in which it was previously used have shown a marked increase, that the decrease in the returns for copperas for 1905 was due to the product not being completely reported, and not to an actual decrease in its production.

Table 144 sets forth the imports of general chemicals from 1891 to 1905, inclusive, for the years ending June 30, as taken from Commerce and Navigation of the United States, published by the Bureau of Statistics.

[1] Twelfth Census, Bulletin No. 210, page 95.

[2] Water Purification for Cities by Sulphate of Iron, American Steel and Wire Company, 1903, page 48.

TABLE 144.—GENERAL CHEMICALS—IMPORTS FOR CONSUMPTION: 1891 TO 1905.

YEAR ENDING JUNE 30—	AQUA, OR WATER, AMMONIA.		AMMONIA, CARBONATE OF, MURIATIC OR SAL-AMMONIAC, AND SULPHATE OF.		POTASH, CHROMATE AND BICHROMATE.		SODA, BICHROMATE AND CHROMATE.		ARGAL, OR ARGOL, OR CRUDE TARTAR.		ARGOLS, OR WINE LEES.		NITRATE OF POTASH, OR SALTPETER, CRUDE.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1891	276,756	$12,858	24,331,113	$740,567	1,234,085	$95,951	545,458	$31,565	21,579,102	$2,197,507			15,040,757	$459,084
1892		3,136	14,275,362	472,276	1,058,521	81,287	703,246	44,091	24,813,171	2,216,525			14,254,514	435,839
1893		718	18,794,599	560,222	969,067	79,174	671,503	44,183	28,770,810	2,341,575			16,560,599	465,666
1894			7,638,848	309,701	1,009,499	83,420	267,397	17,657	22,373,180	1,504,200			9,671,217	251,418
1895			19,836,379	653,146	2,024,776	173,139	600,600	40,321	27,911,122	1,893,730			8,735,290	245,552
1896			30,523,313	804,671	1,444,716	129,339	556,631	38,103	28,481,665	2,724,709			14,758,974	389,524
1897			24,891,603	576,152	1,366,074	112,783	319,641	22,070	23,457,576	1,967,042			19,719,876	408,761
1898			20,595,623	456,273	1,016,029	79,495	295,549	19,027	741,150	65,154	18,461,479	$1,525,873	12,920,986	270,291
1899			19,228,311	520,752	1,099,093	75,254	598,262	29,861			23,300,762	1,914,450	19,985,505	409,818
1900			22,185,935	684,904	645,183	41,449	474,654	21,982			27,339,489	2,388,693	10,332,836	269,739
1901			33,925,826	951,823	200,519	14,401	54,105	2,781			28,598,781	2,476,482	11,361,113	288,897
1902			43,263,326	1,188,579	489,011	31,971	36,567	1,643			29,276,148	2,263,588	9,387,979	264,430
1903			40,193,046	1,191,124	32,376	2,411	33,004	1,509			29,966,557	2,734,027	11,790,415	318,515
1904			40,962,643	1,290,727	38,423	2,554	95,999	4,381			24,571,730	2,550,223	13,518,301	366,526
1905			38,174,070	1,205,361	55,864	3,433	113,562	5,449			26,250,353	2,289,417	14,512,306	386,098

YEAR ENDING JUNE 30—	NITRATE OF SODA.		GLYCERIN.		CAMPHOR, REFINED.		IRON, SULPHATE OF, OR COPPERAS.		LEAD				MAGNESIA, SULPHATE OF, OR EPSOM SALTS.		MILK, SUGAR OF.	
									Brown acetate of.		White acetate of.					
	Tons.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1891	100,428	$2,923,374	13,975,577	$996,686	63	$21	896,937	$4,103			13,279	$707	16,370	$200	251,408	$42,330
1892	109,863	2,976,816	14,197,549	831,810	56,820	17,361	495,596	2,597	2,902	$123	1,220	101	31,742	360	236,869	34,304
1893	94,661	3,062,715	16,540,213	893,636	156,291	51,229	1,010,039	4,099			2,185	154	61,337	480	98,785	12,089
1894	88,079	2,785,048	8,321,853	519,296	137,882	44,233	927,162	3,619			3,217	220	59,294	402	31,346	3,499
1895	124,803	4,124,712	13,488,825	784,613	271,164	83,382	542,316	1,344	3,510	154	59,399	2,822	650	16	14,117	1,828
1896	127,557	3,870,724	21,158,829	1,472,302	153,912	68,785	1,123,443	4,161	30,154	934	48,060	1,873	100,859	691	16,365	2,162
1897	83,331	2,640,389	12,717,098	1,182,099	249,994	84,539	991,000	6,925	26,020	850	3,122	190	240,573	1,122	17,117	2,824
1898	125,081	2,729,750	12,274,987	774,709	170,406	54,602	250,270	1,087	6,008	257	3,594	231	91,137	614	1,844	270
1899	122,314	2,054,805	15,665,252	1,024,131	90,743	28,806	127,041	606	3,437	138	5,145	337	74,186	526	4,064	461
1900	184,247	4,736,807	27,943,106	2,155,414	109,971	42,901	2,700	111	18,192	711	4,093	269	377,274	2,163	2,378	399
1901	203,609	5,776,566	20,369,712	1,722,882	77,313	39,507	24,786	243	11	4	1,500	99	266,290	1,682	3,638	619
1902	192,321	5,565,361	28,576,400	2,358,325	186,882	61,592	38,745	501	79	26	497	48	164,285	1,283	189	23
1903	252,084	7,737,405	35,295,575	2,937,802	43,696	19,399	751	20	21,829	771	214	35	2,438,604	11,427	2,576	480
1904	293,574	9,259,656	31,078,455	2,583,270	152,558	64,234	600	8			64	5	1,591,959	7,729	1,832	296
1905	282,692	9,557,522	27,100,640	2,050,393	214,050	117,277	13	1			372	58	7,100,296	31,283	1,301	239

TABLE 144.—GENERAL CHEMICALS—IMPORTS FOR CONSUMPTION: 1891 TO 1905—Continued.

YEAR ENDING JUNE 30—	REFINED SULPHUR.		SULPHATE OF COPPER, OR BLUE VITRIOL.		HYPOSULPHITE OF SODA.		NITRITE OF SODA.		PHOSPHATE OF SODA.		SILICATE OF SODA OR OTHER ALKALINE SILICATES.		SULPHATE OF SODA, OR GLAUBER'S SALTS.		SULPHATE OF SODA, SALT OR NITER CAKE.	
	Tons.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1891	307	$6,579	3,432	$310							535,030	$6,429	274,784	$2,167	16,927,804	$85,368
1892			2,189	156							571,153	7,090	187,398	2,088	22,465,878	121,900
1893	5	118	8,941	363							608,228	6,991	489,798	4,012	44,180,349	221,846
1894	48	1,255	2,470	140							485,435	5,054	924,874	4,916	11,794,586	43,938
1895	122	2,392	245,787	5,481							492,207	4,562	49,414	4,497	37,248,332	107,459
1896	305	5,338	876,401	28,792							580,310	5,277	1,916,486	9,769	25,692,755	71,801
1897	430	9,111	192,114	6,797	6,965,581	$74,501			505,373	$9,045	600,132	5,468	612,026	3,366	7,748,600	36,590
1898	55	1,542	12,302	518	11,007,111	98,733	155	$37	1,436,171	24,599	417,476	3,971	732,094	7,120	5,228,000	20,652
1899	227	5,802	15,981	342	10,686,997	94,534	5,455	298	3,723,907	59,175	527,531	4,256	519,080	5,828	4,984,940	20,569
1900	186	4,470	2,134	113	8,676,351	78,591	308,386	15,838	2,226,835	43,817	1,306,782	9,536	1,028,240	8,892	6,382,260	29,086
1901	154	4,115	1,788	95	5,222,369	50,639	90,125	4,642	377,834	7,178	1,229,857	10,461	609,040	6,826	6,825,280	34,645
1902	240	5,703	2,703	210	4,808,697	40,942	87,860	4,512	547,688	10,164	1,640,960	14,802	917,500	8,593	3,178,320	16,706
1903	20	482	1,603,524	63,684	3,743,580	34,833	259,372	13,244	1,397,118	22,795	1,113,502	9,526	2,698,700	24,385	4,936,480	27,483
1904	239	5,902	527,329	22,743	2,110,960	23,235	494,235	23,788	497,227	8,583	756,655	9,188	764,600	8,937	2,062,100	12,089
1905	225	5,937	651,660	27,258	1,005,997	10,436	627,446	29,590	79,907	1,462	1,104,215	13,434	709,120	7,202	2,765,100	15,738

TABLE 145.—CHEMICALS—DETAILED

		United States.	California.	Georgia.	Illinois.	Indiana.	Louisiana.
1	Number of establishments	275	15	3	14	3	3
2	Capital, total	$96,621,294	$1,968,880	$292,482	$4,280,108	$143,313	$41,258
3	Land	$8,320,566	$270,569	$25,000	$665,943	$10,889	$4,700
4	Buildings	$18,228,577	$312,983	$56,000	$803,586	$37,700	$8,177
5	Machinery, tools, and implements	$31,911,537	$916,277	$149,870	$1,925,760	$58,156	$22,596
6	Cash and sundries	$38,160,614	$469,051	$61,612	$884,819	$36,568	$5,785
7	Proprietors and firm members	123	3	3	2	2	1
	Salaried officials, clerks, etc.:						
8	Total number	2,778	41	17	123	6	2
9	Total salaries	$4,047,889	$44,376	$21,100	$185,579	$7,344	$1,440
	Officers of corporations—						
10	Number	267	11	3	10		1
11	Salaries	$903,257	$12,600	$8,000	$19,760		$1,040
	General superintendents, managers, clerks, etc.—						
12	Total number	2,511	30	14	113	6	1
13	Total salaries	$3,144,632	$31,776	$13,100	$165,819	$7,344	$400
	Men—						
14	Number	2,240	20	13	105	6	
15	Salaries	$2,992,091	$26,799	$12,860	$162,125	$7,344	
	Women—						
16	Number	271	10	1	8		1
17	Salaries	$152,541	$4,977	$240	$3,694		$400
	Wage-earners and total wages:						
18	Greatest number employed at any one time during the year	22,426	403	31	778	83	16
19	Least number employed at any one time during the year	17,708	195	31	666	63	9
20	Average number	19,806	259	30	721	70	10
21	Total wages	$10,789,780	$189,284	$12,450	$392,140	$35,434	$6,491
	Men 16 years and over—						
22	Average number	18,651	258	29	711	70	7
23	Wages	$10,482,559	$188,764	$12,180	$388,260	$35,434	$5,881
	Women 16 years and over—						
24	Average number	1,081	1	1	10		1
25	Wages	$291,019	$520	$270	$3,880		$100
	Children under 16 years—						
26	Average number	74					2
27	Wages	$16,202					$510
	Average number of wage-earners employed during each month:						
	Men 16 years and over—						
28	January	18,468	302	28	691	71	8
29	February	18,781	267	28	691	68	8
30	March	18,882	256	28	696	67	7
31	April	18,831	244	28	744	68	7
32	May	18,819	272	28	722	66	6
33	June	19,024	229	30	686	70	6
34	July	18,404	184	30	683	71	6
35	August	18,283	192	30	691	73	6
36	September	18,523	248	30	713	69	6
37	October	18,412	273	30	731	70	8
38	November	18,661	328	30	738	74	8
39	December	18,722	301	28	746	73	8
	Women 16 years and over—						
40	January	1,051	1	1	9		3
41	February	1,088	1	1	9		3
42	March	1,104	1	1	9		3
43	April	1,126	1	1	9		3
44	May	1,138	1	1	9		
45	June	1,135	1	1	9		
46	July	1,078	1	1	11		
47	August	1,047	1	1	11		
48	September	1,042	1	1	11		
49	October	1,072	1	1	11		
50	November	1,074	1	1	11		
51	December	1,017	1	1	11		
	Children under 16 years—						
52	January	78					2
53	February	78					3
54	March	77					3
55	April	77					3
56	May	77					3
57	June	77					1
58	July	72					1
59	August	72					1
60	September	74					1
61	October	68					2
62	November	68					2
63	December	70					2
64	Miscellaneous expenses, total	$7,592,852	$109,909	$27,388	$306,119	$18,674	$2,857
65	Rent of works	$155,196	$450	$750	$3,919		$100
66	Taxes	$382,240	$7,960	$844	$12,888	$1,589	$64
67	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$6,899,858	$100,453	$25,794	$289,312	$17,085	$2,693
68	Contract work	$155,558	$1,046				
69	Materials used, total cost	$42,062,611	$700,311	$41,322	$1,354,969	$188,623	$11,146
70	Products, total value	$75,222,249	$1,123,871	$132,740	$2,282,629	$273,087	$29,467

[1] Includes establishments distributed as follows: Alabama, 2; Colorado, 4; Connecticut, 4; District of Columbia, 1; Florida, 1; Louisiana, 2; Maine, 1; Mississippi, 1; Nevada, 1; North Carolina, 2; Texas, 2; West Virginia, 1.

SUMMARY, BY STATES: 1905.

Maryland.	Massachusetts.	Michigan.	Minnesota.	Missouri.	New Jersey.	New York.	Ohio.	Pennsylvania.	Wisconsin.	All other states.[1]	
3	14	14	3	11	47	63	18	41	5	18	1
$1,627,976	$2,651,786	$14,796,767	$98,146	$4,366,417	$16,293,650	$23,149,126	$3,654,791	$20,657,278	$194,072	$2,405,244	2
$179,004	$124,756	$1,144,943		$334,423	$1,227,500	$2,305,797	$190,128	$1,518,130	$1,500	$317,284	3
$118,582	$627,471	$2,561,634	$9,883	$527,224	$2,427,132	$5,200,961	$564,778	$4,530,406	$6,400	$435,660	4
$356,165	$710,047	$7,901,143	$70,434	$567,075	$3,572,940	$7,172,835	$1,782,971	$5,631,938	$101,209	$972,121	5
$974,225	$1,189,512	$3,189,047	$17,829	$2,937,695	$9,066,078	$8,469,533	$1,116,914	$8,976,804	$84,963	$680,179	6
2	3	2	1	1	26	30	10	20	2	6	7
41	106	322	9	186	425	848	260	290	29	64	8
$51,564	$187,768	$388,114	$8,136	$232,684	$678,142	$1,274,141	$400,033	$455,644	$23,195	$88,629	9
5	16	18		18	41	70	24	32		18	10
$17,000	$65,520	$50,983		$55,733	$157,780	$307,188	$89,670	$85,790		$32,193	11
36	90	304	9	168	384	778	245	258	29	40	12
$34,564	$122,248	$337,131	$8,136	$176,951	$520,362	$966,953	$310,363	$369,854	$23,195	$56,436	13
29	74	276	5	137	355	704	220	222	29	45	14
$32,155	$112,937	$323,728	$5,652	$159,069	$502,742	$922,936	$292,334	$351,951	$23,195	$56,264	15
7	16	28	4	31	29	74	25	36		1	16
$2,409	$9,311	$13,403	$2,484	$17,882	$17,620	$44,017	$18,029	$17,903		$172	17
377	977	3,974	8	759	4,028	5,457	1,162	3,521	70	782	18
291	758	2,907	8	572	3,238	4,504	881	3,074	58	453	19
323	800	3,333	8	640	3,597	4,967	1,025	3,373	65	525	20
$141,197	$504,217	$1,848,114	$5,504	$309,673	$1,852,945	$2,677,956	$651,708	$1,891,720	$29,232	$241,715	21
323	777	3,246	8	505	3,141	4,765	1,023	3,213	50	525	22
$141,197	$479,551	$1,835,678	$5,504	$275,657	$1,727,338	$2,624,701	$651,032	$1,843,631	$26,036	$241,715	23
	77	76		102	445	197	2	154	15		24
	$23,306	$9,966		$27,022	$123,125	$52,448	$676	$46,510	$3,196		25
	6	11		33	11	5		5			26
	$1,360	$2,470		$6,994	$2,482	$807		$1,579			27
296	758	3,316	8	481	3,081	4,681	1,065	3,130	50	502	28
295	752	3,452	8	477	3,133	4,711	1,090	3,244	50	507	29
307	746	3,505	8	489	3,169	4,729	1,081	3,249	50	495	30
324	764	3,348	8	496	3,200	4,759	1,063	3,239	53	486	31
327	748	3,303	8	506	3,141	4,835	1,033	3,245	53	526	32
326	766	3,605	8	509	3,156	4,656	1,007	3,206	48	716	33
335	779	3,152	8	529	3,136	4,688	983	3,224	48	548	34
316	800	3,000	8	526	3,101	4,788	983	3,217	48	504	35
336	788	3,060	8	517	3,132	4,868	980	3,224	51	493	36
317	798	3,023	8	511	3,116	4,764	1,005	3,208	50	500	37
344	813	3,049	8	509	3,149	4,842	992	3,223	50	504	38
353	812	3,139	8	510	3,178	4,859	994	3,147	49	517	39
	72	98		88	440	175	1	147	16		40
	75	107		88	457	181	1	148	17		41
	66	111		88	444	208	1	155	17		42
	70	106		88	461	212	2	156	17		43
	68	100		97	473	212	3	157	17		44
	81	28		147	482	212	3	157	14		45
	82	29		127	462	191	3	157	14		46
	90	29		127	431	187	3	154	13		47
	86	27		107	435	200	2	156	16		48
	84	85		89	427	203	2	156	13		49
	86	88		89	430	200	2	153	13		50
	64	104		89	398	183	1	152	13		51
	6	17		33	11	3		6			52
	6	16		33	11	3		6			53
	6	14		33	11	3		7			54
	6	15		33	11	3		6			55
	6	15		33	10	4		6			56
	6	15		33	12	4		6			57
	6	7		33	11	9		5			58
	6	6		33	11	9		6			59
	6	7		33	11	10		6			60
	6	6		33	11	4		6			61
	6	6		33	11	4		6			62
	6	8		33	11	4		6			63
$164,988	$469,446	$1,126,320	$13,590	$250,041	$1,240,764	$2,312,912	$243,096	$1,065,428	$58,126	$183,194	64
$3,497	$4,863	$10,000	$693	$9,946	$26,558	$68,152	$5,244	$8,697	$5,500	$6,828	65
$8,225	$22,242	$57,806	$292	$24,870	$54,112	$117,460	$28,586	$38,472	$644	$6,186	66
$153,266	$440,841	$908,234	$12,606	$214,593	$1,160,094	$2,125,800	$208,666	$1,018,259	$51,982	$170,180	67
	$1,500	$150,280		$632		$1,500	$600				68
$588,897	$1,513,524	$4,402,624	$9,480	$2,172,144	$6,630,468	$12,958,436	$3,002,610	$7,265,245	$137,414	$1,085,398	69
$1,081,778	$3,508,759	$9,037,450	$53,644	$3,278,993	$13,023,629	$23,021,705	$4,589,749	$11,773,719	$265,457	$1,745,572	70

TABLE 145.—CHEMICALS—DETAILED

		United States.	California.	Georgia.	Illinois.	Indiana.	Louisiana.
	Power:						
71	Number of establishments reporting	237	14	2	13	3	2
72	Total horsepower	140,372	1,060	109	3,854	340	85
	Owned—						
	Engines—						
	Steam—						
73	Number	1,081	23	2	31	4	4
74	Horsepower	70,194	741	54	2,816	245	85
	Gas and gasoline—						
75	Number	25	8				
76	Horsepower	438	119				
	Water wheels—						
77	Number	25					
78	Horsepower	6,455					
	Water motors—						
79	Number	3					
80	Horsepower	14					
	Electric motors—						
81	Number	409			40	9	
82	Horsepower	8,110			980	95	
83	Other power, horsepower	1,097	200		25		
	Rented—						
	Electric motors—						
84	Number	263		2	2		
85	Horsepower	10,078		55	8		
86	Other kind, horsepower	43,986			25		
87	Furnished to other establishments, horsepower	319	30				

TABLE 146.—PAINTS—DETAILED

		United States.	California.	Delaware.	Georgia.	Illinois.	Indiana.	Iowa.	Kansas.	Kentucky.	Maryland.	Massachusetts.
1	Number of establishments	449	18	4	5	39	9	5	3	10	11	23
2	Capital, total	$55,783,259	$1,439,985	$118,478	$156,894	$7,828,577	$174,869	$60,798	$28,350	$328,904	$443,500	$1,625,359
3	Land	$6,410,389	$44,000	$14,000	$5,000	$510,300	$5,000	$3,000		$22,900	$26,000	$142,053
4	Buildings	$7,081,890	$160,247	$12,800	$7,000	$910,926	$13,457	$5,200		$56,000	$22,500	$187,631
5	Machinery, tools, and implements	$8,533,218	$241,571	$23,815	$16,802	$976,031	$36,383	$3,760	$10,000	$58,861	$79,900	$157,066
6	Cash and sundries	$33,757,762	$994,167	$67,863	$128,092	$5,431,320	$120,029	$48,838	$18,350	$191,143	$315,100	$1,138,609
7	Proprietors and firm members	328	10	2	7	10	7	4	2	4	16	21
	Salaried officials, clerks, etc.:											
8	Total number	3,044	88	7	22	422	13	13	2	29	55	76
9	Total salaries	$3,654,289	$84,912	$8,500	$19,052	$616,167	$13,828	$12,438	$2,050	$27,286	$50,708	$103,872
	Officers of corporations—											
10	Number	357	6	3	2	51	2	1		10	2	13
11	Salaries	$935,701	$9,300	$5,400	$3,400	$161,269	$3,700	$60		$13,120	$1,600	$36,900
	General superintendents, managers, clerks, etc.—											
12	Total number	2,687	82	4	20	371	11	12	2	19	53	63
13	Total salaries	$2,718,588	$75,612	$3,100	$15,652	$454,898	$10,128	$12,378	$2,050	$14,166	$49,108	$66,972
	Men—											
14	Number	2,201	72	4	18	288	11	10	2	15	43	52
15	Salaries	$2,463,840	$70,200	$3,100	$14,987	$408,966	$10,128	$11,650	$2,050	$12,120	$44,720	$60,922
	Women—											
16	Number	486	10		2	83		2		4	10	11
17	Salaries	$254,748	$5,412		$665	$45,932		$728		$2,046	$4,388	$6,050
	Wage-earners, including pieceworkers, and total wages:											
18	Greatest number employed at any one time during the year.	11,570	311	34	31	1,282	48	16	13	97	196	485
19	Least number employed at any one time during the year.	7,830	246	25	27	755	38	13	10	70	162	309
20	Average number	9,781	275	28	28	1,029	38	12	11	88	182	398
21	Total wages	$5,063,177	$184,942	$21,229	$12,140	$595,077	$17,629	$7,949	$5,265	$31,461	$73,697	$211,141
	Men 16 years and over—											
22	Average number	8,775	264	24	27	923	31	12	10	59	172	365
23	Wages	$4,777,392	$180,665	$19,079	$11,932	$561,767	$15,761	$7,949	$4,940	$26,032	$71,617	$201,249
	Women 16 years and over—											
24	Average number	965	8	2	1	106	7		1	29	10	33
25	Wages	$276,551	$3,497	$1,400	$208	$33,310	$1,868		$325	$5,429	$2,080	$9,892
	Children under 16 years—											
26	Average number	41	3	2								
27	Wages	$9,234	$780	$750								
	Average number of wage-earners, including pieceworkers, employed during each month:											
	Men 16 years and over—											
28	January	8,226	243	27	26	857	30	12	10	55	169	324
29	February	8,688	245	26	26	925	30	12	10	55	172	334
30	March	9,025	249	29	26	1,050	29	12	9	59	172	337
31	April	9,331	260	27	26	1,056	30	12	11	61	177	370
32	May	9,039	273	24	26	1,034	30	12	10	61	181	385
33	June	9,036	282	22	29	944	33	12	10	63	178	364
34	July	8,587	271	21	29	862	36	12	11	63	164	359
35	August	8,599	271	21	29	841	33	12	11	61	162	384
36	September	8,768	261	23	29	870	30	12	11	60	173	406
37	October	8,880	276	23	26	894	30	12	9	60	180	387
38	November	8,725	271	23	26	884	32	12	9	55	168	376
39	December	8,396	266	22	26	859	29	12	9	55	168	345

[1] Includes establishments distributed as follows: Alabama, 2; Colorado, 4; Connecticut, 4; District of Columbia, 1; Florida, 1; Louisiana, 2; Maine, 1; Mississippi, 1; Nevada, 1; North Carolina, 2; Texas, 2; West Virginia, 1.

SUMMARY, BY STATES: 1905—Continued.

Maryland.	Massachusetts.	Michigan.	Minnesota.	Missouri.	New Jersey.	New York.	Ohio.	Pennsylvania.	Wisconsin.	All other states.	
3	11	14	3	9	41	56	12	37	4	13	71
625	3,431	24,048	62	1,593	10,168	70,178	6,419	11,161	243	6,996	72
15	24	233	1	24	164	292	73	162	5	24	73
625	2,495	20,850	15	1,330	8,571	15,259	5,734	10,342	243	789	74
...	...	...	...	...	2	9	3	3	...	1	75
...	...	...	...	...	9	241	30	37	...	2	76
...	2	...	...	...	...	5	...	1	...	17	77
...	75	...	...	...	...	529	...	1	...	5,850	78
...	...	...	...	...	1	2	...	...	...	...	79
...	...	...	...	...	2	12	...	...	...	...	80
...	27	85	...	[illegible]	51	112	10	21	...	6	81
...	150	1,188	...	263	1,086	3,529	250	499	...	70	82
...	...	...	...	...	...	10	405	176	...	281	83
...	13	53	1	...	28	155	...	9	...	...	84
...	707	2,010	2	...	165	7,043	...	88	...	...	85
...	4	...	45	...	335	43,555	...	18	...	4	86
10	...	40	...	90	110	9	...	...	...	30	87

SUMMARY, BY STATES: 1905.

Michigan.	Minnesota.	Missouri.	Nebraska.	New Jersey.	New York.	Ohio.	Oregon.	
11	5	20	3	20	89	49	3	1
$2,459,256	$672,324	$3,906,906	$226,597	$2,421,247	$14,852,314	$6,096,266	$159,600	2
$144,837	$30,000	$313,926	$10,500	$197,940	$2,704,007	$659,700	$8,000	3
$489,083	$85,000	$362,164	$34,699	$519,693	$1,434,597	$942,044	$9,000	4
$321,174	$83,676	$501,322	$22,134	$466,635	$2,118,555	$831,892	$40,000	5
$1,504,162	$473,648	$2,729,494	$159,264	$1,236,979	$8,595,155	$3,662,630	$102,600	6
8	2	7	1	15	76	24	5	7
198	45	385	20	102	651	349	3	8
$229,741	$56,052	$420,283	$34,160	$139,895	$834,548	$389,216	$3,300	9
19	8	31	2	19	48	49	...	10
$56,925	$15,680	$68,870	$9,600	$43,434	$174,710	$114,805	...	11
179	37	354	18	83	603	300	3	12
$172,816	$40,372	$351,413	$24,560	$96,461	$659,838	$274,411	$3,300	13
146	31	301	16	61	499	239	2	14
$155,652	$35,692	$321,853	$23,180	$85,109	$602,954	$242,440	$2,700	15
33	6	53	2	22	104	61	1	16
$17,164	$4,680	$29,560	$1,380	$11,352	$56,884	$31,971	$600	17
594	94	677	45	747	3,183	1,121	19	18
394	65	399	37	587	2,099	725	13	19
497	78	567	40	667	2,711	941	15	20
$222,966	$37,390	$290,009	$18,502	$339,023	$1,464,270	$475,045	$13,230	21
410	63	534	33	589	2,381	834	15	22
$203,325	$32,266	$279,609	$16,260	$317,791	$1,373,164	$446,605	$13,230	23
82	15	30	7	74	316	106	...	24
$18,641	$5,124	$9,854	$2,242	$20,528	$88,195	$28,240	...	25
5	...	3	...	4	14	1	...	26
$1,000	...	$546	...	$704	$2,911	$200	...	27
351	64	439	33	549	2,306	788	18	28
380	67	522	34	568	2,425	869	17	29
386	70	548	34	597	2,456	912	17	30
402	75	582	34	604	2,575	912	12	31
412	68	555	34	615	2,391	831	13	32
434	72	576	34	603	2,431	827	12	33
415	61	551	31	578	2,315	765	13	34
419	60	542	32	567	2,352	747	13	35
446	56	530	33	595	2,353	826	14	36
442	54	543	32	601	2,421	846	13	37
444	54	526	32	612	2,320	846	19	38
389	55	494	33	579	2,227	839	19	39

Pennsylvania.	Rhode Island.	Tennessee.	Virginia.	Washington.	Wisconsin.	All other states.[1]	
74	4	4	3	6	9	22	1
$10,355,786	$112,017	$224,299	$213,034	$121,475	$935,863	$820,561	2
$1,329,235	$4,000	$15,625	$25,690	$8,950	$87,950	$97,776	3
$1,418,755	$14,840	$27,533	$46,456	$16,250	$187,028	$118,987	4
$2,071,906	$22,700	$23,399	$80,112	$24,450	$153,179	$167,895	5
$5,535,890	$70,477	$157,742	$60,776	$71,825	$507,706	$435,903	6
73	5	1	5	1	6	16	7
416	13	14	17	27	34	43	8
$441,655	$15,332	$24,880	$27,590	$14,322	$30,120	$54,382	9
61	2	5	3	2	5	13	10
$146,568	$7,500	$11,700	$12,000	$900	$11,150	$27,110	11
355	11	9	14	25	29	30	12
$295,087	$7,832	$13,180	$15,590	$13,422	$18,970	$27,272	13
295	7	7	13	22	19	28	14
$266,886	$5,960	$11,800	$15,090	$12,450	$16,375	$26,856	15
60	4	2	1	3	10	2	16
$28,201	$1,872	$1,380	$500	$972	$2,595	$416	17
1,945	22	90	98	41	190	191	18
1,385	22	56	83	34	142	134	19
1,645	22	76	93	34	152	154	20
$798,313	$13,065	$30,356	$23,148	$23,440	$70,182	$83,708	21
1,532	22	62	93	32	145	143	22
$760,841	$13,065	$26,927	$23,148	$22,972	$67,374	$79,824	23
106	...	13	...	2	7	10	24
$35,525	...	$3,189	...	$468	$2,808	$3,728	25
7	...	1	...	...	...	1	26
$1,947	...	$240	...	...	...	$156	27
1,476	22	49	93	31	130	124	28
1,507	22	61	93	31	131	126	29
1,539	22	65	93	33	144	137	30
1,580	22	63	93	37	154	147	31
1,564	22	63	93	37	159	146	32
1,583	22	64	93	31	162	155	33
1,511	22	63	93	27	156	158	34
1,536	22	63	93	26	148	154	35
1,535	22	65	93	25	147	153	36
1,521	22	65	93	34	146	150	37
1,537	22	60	93	34	133	137	38
1,495	22	63	93	38	130	129	39

TABLE 146.—PAINTS—DETAILED

		United States.	California.	Delaware.	Georgia.	Illinois.	Indiana.	Iowa.	Kansas.	Kentucky.	Maryland.	Massachusetts.
	Average number of wage-earners, including pieceworkers, employed during each month—Continued.											
	Women 16 years and over—											
40	January	929	7	2	1	112	6	....	1	26	10	23
41	February	969	7	3	1	117	6	....	1	26	10	36
42	March	1,037	8	3	1	125	7	....	1	31	10	37
43	April	1,038	8	3	1	123	7	....	1	31	10	36
44	May	1,053	9	3	1	124	7	....	1	31	10	30
45	June	1,037	11	2	1	108	8	....	1	31	10	29
46	July	938	8	1	1	94	8	....	1	31	10	36
47	August	918	8	1	1	90	7	....	1	31	10	34
48	September	935	9	1	1	92	7	....	1	30	10	33
49	October	907	8	1	1	89	7	....	1	30	10	31
50	November	910	7	2	1	91	7	....	1	25	10	32
51	December	909	6	2	1	107	7	....	1	25	10	39
	Children under 16 years—											
52	January	39	3	2	....	....	....	....	....	....	....	....
53	February	44	3	2	....	....	....	....	....	....	....	....
54	March	46	3	2	....	....	....	....	....	....	....	....
55	April	47	3	3	....	....	....	....	....	....	....	....
56	May	43	4	3	....	....	....	....	....	....	....	....
57	June	43	3	3	....	....	....	....	....	....	....	....
58	July	38	3	1	....	....	....	....	....	....	....	....
59	August	38	3	1	....	....	....	....	....	....	....	....
60	September	38	2	1	....	....	....	....	....	....	....	....
61	October	42	3	2	....	....	....	....	....	....	....	....
62	November	37	3	2	....	....	....	....	....	....	....	....
63	December	37	3	2	....	....	....	....	....	....	....	....
64	Miscellaneous expenses, total	$6,055,367	$102,521	$5,851	$25,940	$1,086,502	$24,602	$9,015	$4,460	$33,483	$42,422	$172,483
65	Rent of works	$300,541	$9,829	$1,600	$3,245	$35,462	$6,131	$395	$1,890	$2,050	$8,250	$15,363
66	Taxes	$221,715	$3,205	$464	$1,457	$30,306	$1,068	$445	$395	$807	$1,812	$10,545
67	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$5,441,870	$89,487	$3,787	$21,238	$1,020,734	$17,403	$7,660	$2,175	$30,626	$32,360	$146,575
68	Contract work	$91,241	....	....	....	....	....	$515	....	....	....	....
69	Materials used, total cost	$46,306,183	$1,568,269	$41,252	$155,396	$6,523,137	$135,276	$50,449	$36,110	$264,321	$410,884	$1,414,110
70	Products, total value	$67,277,910	$2,221,846	$81,552	$257,903	$9,484,280	$225,809	$86,074	$59,800	$522,017	$680,990	$2,159,680
	Power:											
71	Number of establishments reporting	402	17	4	5	35	8	3	3	7	10	22
72	Total horsepower	42,148	927	195	102	5,210	290	76	51	523	519	1,414
	Owned—											
	Engines—											
	Steam—											
73	Number	369	2	3	1	25	3	2	1	2	8	21
74	Horsepower	31,628	229	185	30	3,620	200	66	25	275	425	1,189
	Gas and gasoline—											
75	Number	72	5	1	1	9	2	2	....	1	5	1
76	Horsepower	1,471	105	10	15	257	48	7	....	12	79	12
	Water wheels—											
77	Number	22	....	....	....	1	....	....	....	....	....	2
78	Horsepower	969	....	....	....	15	....	....	....	....	....	65
	Water motors—											
79	Number	6	....	....	....	....	....	....	....	....	....	....
80	Horsepower	18	....	....	....	....	....	....	....	....	....	....
	Electric motors—											
81	Number	267	18	....	....	20	....	....	....	6	2	....
82	Horsepower	4,693	318	....	....	759	....	....	....	125	10	....
	Rented—											
	Electric motors—											
83	Number	168	21	....	3	38	7	1	2	5	1	3
84	Horsepower	2,394	275	....	57	507	42	3	26	111	5	23
85	Other kind, horsepower	975	....	....	....	52	....	....	....	....	....	125
86	Furnished to other establishments, horsepower.	234	....	....	....	5	....	....	....	25	....	....

TABLE 147.—FERTILIZERS—DETAILED

		United States.	Alabama.	California.	Connecticut.	Delaware.	Florida.	Georgia.	Illinois.	Indiana.	Kentucky.
1	Number of establishments	400	19	14	10	7	8	57	4	14	4
2	Capital, total	$69,023,264	$3,050,922	$903,849	$987,378	$205,554	$899,049	$11,158,070	$546,171	$235,195	$872,487
3	Land	$4,813,130	$91,033	$60,450	$104,050	$5,700	$9,000	$368,345	$115,200	$8,100	$70,000
4	Buildings	$11,366,004	$588,533	$125,466	$174,489	$17,300	$99,444	$1,765,685	$146,261	$54,700	$476,280
5	Machinery, tools, and implements	$9,023,201	$362,661	$107,876	$171,419	$34,500	$119,001	$1,354,012	$105,218	$74,723	$77,820
6	Cash and sundries	$43,820,929	$2,008,695	$610,057	$537,420	$148,054	$670,704	$7,670,028	$179,492	$97,672	$248,387
7	Proprietors and firm members	294	6	10	6	8	1	40	....	20	2
	Salaried officials, clerks, etc.:										
8	Total number	1,618	79	35	32	5	61	210	13	13	15
9	Total salaries	$1,940,712	$67,539	$39,231	$36,712	$4,440	$63,179	$260,344	$16,318	$14,050	$13,762
	Officers of corporations—										
10	Number	266	16	5	11	....	10	44	1	3	3
11	Salaries	$554,542	$24,725	$6,000	$19,000	....	$22,590	$86,986	$720	$5,000	$4,842
	General superintendents, managers, clerks, etc.—										
12	Total number	1,352	63	30	21	5	51	166	12	10	12
13	Total salaries	$1,386,170	$42,814	$33,231	$17,712	$4,440	$40,589	$173,358	$15,598	$9,050	$8,920
	Men—										
14	Number	1,250	63	29	18	5	44	162	9	9	9
15	Salaries	$1,332,426	$42,814	$32,511	$16,680	$4,440	$36,213	$170,774	$14,358	$8,750	$7,620
	Women—										
16	Number	102	....	1	3	....	7	4	3	1	3
17	Salaries	$53,744	....	$720	$1,032	....	$4,376	$2,584	$1,240	$300	$1,300

[1] Includes establishments distributed as follows: Alaska, 1; District of Columbia, 1; Kansas, 1; Michigan, 1; Missouri, 2; Nebraska, 1; Oregon, 1; Rhode Island, 1; Washington, 2.

SUMMARY, BY STATES: 1905—Continued.

Michigan.	Minnesota.	Missouri.	Nebraska.	New Jersey.	New York.	Ohio.	Oregon.	Pennsylvania.	Rhode Island.	Tennessee.	Virginia.	Washington.	Wisconsin.	All other states.	
76	16	27	7	68	308	103	...	103	...	12	...	2	10	9	40
76	17	30	7	72	308	109	...	107	...	14	...	2	10	10	41
76	17	32	7	77	341	115	...	111	...	14	...	2	10	12	42
76	15	32	7	80	337	121	...	116	...	13	...	2	7	12	43
77	16	31	8	81	333	122	...	136	...	14	...	2	7	10	44
78	14	31	7	82	354	112	...	125	...	14	...	2	7	10	45
91	14	28	6	75	290	106	...	103	...	9	...	2	6	9	46
92	14	28	7	74	289	100	...	103	...	10	...	2	6	10	47
92	14	28	7	71	307	99	...	101	...	14	...	2	6	10	48
91	15	32	7	69	303	95	...	87	...	13	...	2	5	10	49
92	14	29	7	70	305	96	...	90	...	14	...	2	5	10	50
67	14	32	7	69	308	94	...	90	...	15	...	2	5	8	51
5	...	3	...	3	13	1	...	7	...	1	...	...	...	1	52
5	...	3	...	3	17	1	...	8	...	1	...	...	...	1	53
5	...	3	...	3	19	1	...	8	...	1	...	...	...	1	54
5	...	3	...	3	18	1	...	9	...	1	...	...	...	1	55
5	...	3	...	3	15	1	...	7	...	1	...	...	...	1	56
5	...	3	...	4	16	1	...	6	...	1	...	...	...	1	57
5	...	3	...	5	12	1	...	6	...	1	...	...	...	1	58
5	...	3	...	6	11	1	...	6	...	1	...	...	...	1	59
5	...	3	...	6	12	1	...	6	...	1	...	...	...	1	60
5	...	3	...	6	13	1	...	7	...	1	...	...	...	1	61
5	...	3	...	3	11	1	...	7	...	1	...	...	...	1	62
5	...	3	...	3	11	1	...	7	...	1	...	...	...	1	63
$459,284	$104,930	$351,963	$36,989	$286,535	$1,451,586	$573,114	$15,967	$947,468	$27,595	$52,689	$16,578	$11,713	$67,018	$144,659	64
$1,825	$9,170	$14,170	$600	$8,333	$92,749	$23,707	$1,350	$47,770	$3,450	...	$3,197	$1,480	$2,700	$5,845	65
$12,244	$2,335	$17,350	$1,482	$13,693	$53,347	$34,210	$567	$26,995	$343	$941	$648	$543	$3,494	$3,019	66
$445,215	$93,425	$319,883	$34,907	$258,489	$1,305,168	$447,697	$14,050	$856,379	$23,822	$51,748	$12,733	$9,690	$60,824	$135,795	67
...	...	$560	...	$6,020	$322	$67,500	...	$16,324	...	...	...	...	...	...	68
$1,524,294	$454,222	$4,588,108	$237,137	$2,250,984	$13,220,075	$4,700,988	$189,886	$6,659,353	$176,622	$287,990	$113,696	$92,414	$764,005	$447,205	69
$2,823,933	$708,924	$6,144,521	$346,645	$3,511,375	$18,721,872	$6,601,428	$267,200	$9,428,890	$247,842	$480,991	$194,594	$165,924	$1,048,037	$805,783	70
11	4	17	3	20	76	47	3	69	3	4	3	4	8	16	71
1,581	222	1,989	170	2,969	10,545	5,190	102	7,370	137	295	645	80	731	815	72
10	2	18	4	26	80	48	...	88	2	4	1	1	6	11	73
1,144	150	1,684	160	2,024	8,262	3,595	...	6,339	125	295	450	35	655	466	74
1	...	...	1	1	11	11	...	14	1	...	...	...	2	3	75
14	...	...	10	8	169	265	...	395	12	...	...	...	31	22	76
...	...	...	...	2	5	...	...	6	...	...	3	...	...	2	77
...	...	...	...	40	293	...	...	131	...	...	175	...	...	250	78
...	...	5	...	...	...	...	...	1	...	...	...	...	...	...	79
...	...	13	...	...	...	...	...	5	...	...	...	...	...	...	80
29	...	2	...	57	54	44	...	26	...	...	...	...	...	...	81
398	...	16	...	735	790	1,128	...	414	...	...	...	...	...	...	82
3	5	15	...	4	27	14	4	7	...	...	1	3	2	2	83
25	72	276	...	71	485	136	102	41	...	...	20	45	45	27	84
...	...	...	...	91	546	66	...	45	...	...	...	...	...	50	85
...	...	...	...	...	183	1	...	...	20	...	...	...	...	...	86

SUMMARY, BY STATES: 1905.

Louisiana.	Maine.	Maryland.	Massachusetts.	Mississippi.	New Jersey.	New York.	North Carolina.	Ohio.	Pennsylvania.	South Carolina.	Tennessee.	Virginia.	All other states.[1]	
4	3	39	9	5	25	13	27	17	43	20	10	37	11	1
$2,143,846	$53,683	$6,058,246	$3,600,183	$1,048,733	$6,290,706	$2,598,356	$3,697,799	$3,551,267	$5,386,058	$7,086,878	$3,381,073	$4,871,810	$395,951	2
$119,206	$4,500	$827,565	$163,772	$26,432	$776,619	$167,700	$90,245	$237,552	$621,528	$232,958	$350,871	$336,304	$26,000	3
$190,737	$11,000	$894,595	$354,991	$153,508	$846,855	$499,379	$596,182	$604,435	$796,788	$1,559,265	$680,244	$629,607	$100,260	4
$388,386	$7,500	$815,518	$490,240	$106,050	$1,060,845	$195,975	$312,356	$509,090	$693,256	$728,330	$434,146	$765,356	$108,023	5
$1,445,517	$30,683	$3,520,568	$2,591,180	$762,743	$3,606,387	$1,735,302	$2,699,016	$2,200,190	$3,274,486	$4,566,325	$1,915,812	$3,140,543	$161,668	6
...	4	38	6	...	23	9	33	8	48	1	6	16	9	7
36	1	206	66	23	91	68	78	106	129	149	67	118	17	8
$65,997	$1,354	$229,734	$85,202	$28,273	$150,985	$99,664	$75,070	$135,847	$169,796	$153,045	$98,219	$111,287	$20,664	9
11	...	24	...	5	14	11	13	13	23	17	12	23	7	10
$39,654	...	$51,600	...	$9,350	$46,500	$22,200	$23,469	$28,900	$45,825	$40,300	$35,152	$32,009	$9,720	11
25	1	182	66	18	77	57	65	93	106	132	55	95	10	12
$26,343	$1,354	$178,134	$85,202	$18,923	$104,485	$77,464	$51,601	$106,947	$123,971	$112,745	$63,067	$79,278	$10,944	13
25	1	172	40	18	69	55	64	77	91	128	53	91	9	14
$26,343	$1,354	$173,506	$74,860	$18,923	$99,680	$76,132	$51,121	$97,776	$117,041	$111,005	$62,387	$77,578	$10,560	15
...	...	10	17	...	8	2	1	16	15	4	2	4	1	16
...	...	$4,628	$10,342	...	$4,805	$1,332	$480	$9,171	$6,930	$1,740	$680	$1,700	$384	17

TABLE 147.—FERTILIZERS—DETAILED

		United States.	Alabama.	California.	Connecticut.	Delaware.	Florida.	Georgia,	Illinois.	Indiana.	Kentucky.
	Wage-earners, including pieceworkers, and total wages:										
18	Greatest number employed at any one time during the year.	28,432	1,241	194	433	283	494	5,285	113	303	87
19	Least number employed at any one time during the year.	8,666	271	87	204	[illegible]	145	1,724	20	71	42
20	Average number	14,201	551	123	310	149	242	2,192	48	97	57
21	Total wages	$5,142,147	$152,713	$69,389	$124,198	$33,371	$70,259	$581,184	$24,472	$45,526	$19,329
	Men 16 years and over—										
22	Average number	14,065	550	123	252	149	236	2,188	48	97	57
23	Wages	$5,113,232	$152,665	$69,389	$109,837	$33,371	$69,451	$580,757	$24,472	$45,526	$19,329
	Women 16 years and over—										
24	Average number	110			58		[illegible]				
25	Wages	$25,446			$14,361		$808				
	Children under 16 years—										
26	Average number	26	1					[illegible]			
27	Wages	$3,469	$48					$427			
	Average number of wage-earners, including pieceworkers, employed during each month:										
	Men 16 years and over—										
28	January	15,069	799	139	181	83	279	3,642	40	66	46
29	February	18,614	882	130	187	124	350	4,467	55	69	43
30	March	20,666	835	123	211	142	375	4,594	54	81	66
31	April	16,908	514	112	261	130	255	2,787	49	77	71
32	May	13,111	350	116	314	128	181	1,479	47	70	47
33	June	11,014	325	113	302	99	198	983	44	77	47
34	July	11,084	395	107	287	179	182	1,031	44	94	47
35	August	12,230	422	118	290	178	160	1,114	57	129	51
36	September	14,060	419	136	274	190	192	1,258	91	297	85
37	October	12,494	427	127	285	204	198	1,318	37	82	85
38	November	11,566	530	117	244	231	197	1,548	39	61	51
39	December	11,964	702	138	188	100	265	2,035	19	61	45
	Women 16 years and over—										
40	January	122			60		6				
41	February	130			60		6				
42	March	125			63		6				
43	April	130			69		5				
44	May	106			52		[illegible]				
45	June	97			55		[illegible]				
46	July	96			53		[illegible]				
47	August	109			56		6				
48	September	96			52		[illegible]				
49	October	103			56		6				
50	November	99			58		[illegible]				
51	December	107			62		7				
	Children under 16 years—										
52	January	61	6					10			
53	February	59	3					13			
54	March	43						15			
55	April	29						7			
56	May	14						3			
57	June	11									
58	July	14									
59	August	14									
60	September	14									
61	October	16									
62	November	17									
63	December	20	3								
64	Miscellaneous expenses, total	$4,919,824	$147,806	$66,851	$81,088	$58,293	$81,983	$718,325	$49,252	$31,342	$74,622
65	Rent of works	$76,895	$700	$3,452		$250	$6,342	$1,425	$220	$1,560	$825
66	Taxes	$249,282	$9,542	$2,725	$3,570	$583	$2,307	$30,932	$3,306	$1,340	$4,262
67	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.	$4,550,015	$137,564	$60,674	$77,518	$57,460	$73,334	$681,968	$45,726	$28,442	$69,535
68	Contract work	$43,632						$4,000			
69	Materials used, total cost	$39,343,914	$1,606,330	$519,169	$524,891	$287,414	$1,325,070	$6,527,065	$90,702	$156,017	$279,151
70	Products, total value	$56,632,853	$2,341,132	$893,711	$943,221	$370,889	$1,590,371	$9,461,415	$131,298	$298,677	$439,111
	Power:										
71	Number of establishments reporting	350	16	11	9	5	8	47	4	13	4
72	Total horsepower	50,986	1,485	852	657	665	555	7,283	445	652	455
	Owned—										
	Engines—										
	Steam—										
73	Number	721	30	7	11	19	6	[illegible]	5	12	8
74	Horsepower	44,752	1,465	505	453	665	350	6,277	440	600	440
	Gas and gasoline—										
75	Number	17	1		1			6		1	
76	Horsepower	246	15		25			38		[illegible]	
	Water wheels—										
77	Number	15			2						
78	Horsepower	353			79						
	Electric motors—										
79	Number	126			2			18			2
80	Horsepower	2,917			50			752			15
81	Other power, horsepower	185						10			
	Rented—										
	Electric motors—										
82	Number	78	1	11	2		7	4	1		
83	Horsepower	2,358	5	272	50		205	206	5		
84	Other kind, horsepower	175		75							
85	Furnished to other establishments, horsepower	190								50	

SUMMARY, BY STATES: 1905—Continued.

Louisiana.	Maine.	Maryland.	Massachusetts.	Mississippi.	New Jersey.	New York.	North Carolina.	Ohio.	Pennsylvania.	South Carolina.	Tennessee.	Virginia.	All other states.	
754	61	2,236	550	527	1,679	851	2,094	1,128	1,331	3,217	1,747	3,271	553	18
193	22	760	241	151	770	400	525	300	762	371	351	932	228	19
344	26	1,256	358	348	1,139	596	908	490	958	1,071	781	1,801	356	20
$122,969	$11,910	$524,353	$183,163	$78,847	$637,320	$254,049	$281,775	$235,269	$446,564	$303,885	$209,593	$571,177	$160,832	21
309	26	1,247	355	348	1,124	596	907	490	955	1,071	781	1,800	356	22
$118,364	$11,910	$521,867	$182,359	$78,847	$632,445	$254,049	$281,666	$235,269	$446,266	$303,885	$209,593	$571,083	$160,832	23
23		8	3		12									24
$2,940		$2,186	$804		$4,347									25
12		1			3		1		3			1		26
$1,665		$300			$528		$109		$298			$94		27
461	20	793	345	538	950	480	787	345	817	1,454	1,009	1,484	311	28
572	20	906	409	643	1,150	506	1,137	366	906	2,313	1,435	1,641	303	29
472	21	1,389	403	853	1,340	598	1,411	453	983	2,408	1,492	1,872	400	30
319	23	1,555	518	487	1,384	654	1,310	582	1,226	1,216	946	2,072	360	31
320	25	1,315	478	199	1,202	647	897	395	965	829	500	2,246	361	32
174	24	1,332	297	171	1,069	584	554	379	898	659	432	1,779	474	33
194	21	1,277	294	104	1,054	630	563	407	892	675	460	1,670	477	34
200	31	1,497	271	104	1,022	651	714	725	1,043	624	596	1,833	400	35
230	36	1,938	279	118	1,120	636	890	1,084	1,180	588	756	1,976	287	36
248	35	1,190	287	251	1,172	578	1,061	415	897	656	719	1,946	276	37
238	35	870	290	313	986	635	851	371	810	712	524	1,602	311	38
280	21	902	299	395	1,039	553	709	358	843	718	503	1,479	312	39
31		6	4		15									40
35		10	4		15									41
24		10	4		18									42
25		10	4		17									43
23		9	4		12									44
18		8	4		11									45
20		7	4		6									46
22		14	4		7									47
19		12			7									48
21		9			11									49
19		2	2		12									50
19		4	2		13									51
34					3		1		4			3		52
32					3		1		1			3		53
17					3		1		4			3		54
10					3		1		5			3		55
4					3		1		3					56
4					3		1		3					57
5		2			3		1		3					58
5		2			3		1		3					59
5		2			3		1		3					60
8		2			3		1		2					61
10		2			3		1		1					62
10		2			3		1		1					63
$230,450	$9,748	$472,559	$244,951	$61,499	$484,020	$205,057	$285,213	$258,914	$415,286	$231,137	$297,433	$336,767	$77,228	64
$200		$25,758	$9,138		$1,282	$240	$54		$19,519	$2,400	$560	$1,625	$345	65
$3,942	$1,690	$31,643	$8,562	$4,521	$20,497	$13,254	$27,033	$10,642	$11,744	$19,948	$16,208	$18,405	$2,626	66
$226,308	$8,058	$414,158	$227,251	$56,978	$461,028	$188,874	$254,585	$248,272	$367,726	$206,478	$280,665	$303,156	$74,257	67
					$1,213	$2,689	$3,541		$16,297	$2,311		$13,581		68
$1,013,640	$38,765	$4,991,789	$1,276,299	$857,412	$3,928,047	$1,333,868	$2,217,756	$1,386,446	$2,890,780	$2,692,031	$1,711,800	$3,240,675	$448,797	69
$1,556,227	$66,054	$6,631,763	$1,978,356	$1,082,387	$5,651,914	$2,082,404	$3,098,561	$2,289,176	$4,094,978	$3,637,576	$2,700,561	$4,659,281	$633,790	70
4	3	31	9	5	20	13	22	17	39	19	9	33	9	71
910	228	4,293	2,575	645	4,370	1,537	2,653	3,218	4,589	4,286	2,030	5,653	950	72
10	6	45	21	7	46	21	53	34	80	58	29	119	12	73
860	165	3,533	1,920	645	3,437	1,014	2,428	2,630	4,426	4,011	1,970	5,568	950	74
		2			2		1		1			2		75
		35			88		10		25			8		76
	2	2			1				6			2		77
	63	45			30				100			36		78
		25	9		44			19	3		3	1		79
		300	280		815			588	38		60	10		80
			175											81
2		10	4			21	6			6		3		82
50		371	200			523	215			225		31		83
										50				84
		90	100											85

TABLE 148.—EXPLOSIVES—DETAILED SUMMARY, BY STATES: 1905.

	United States.	Illinois.	Indiana.	Michigan.	Missouri.	New York.	Ohio.	Pennsylvania.	All other states.[1]
Number of establishments	124	5	7	4	4	5	16	40	43
Capital, total	$42,307,163	$774,776	$2,096,288	$315,473	$2,364,490	$507,948	$2,868,417	$5,320,285	$28,059,486
Land	$2,484,354	$50,246	$56,545	$9,400	$146,624	$38,237	$208,667	$310,723	$1,663,912
Buildings	$6,605,693	$161,135	$282,245	$51,129	$363,193	$79,502	$582,511	$789,731	$4,296,247
Machinery, tools, and implements	$8,358,003	$262,141	$452,557	$22,945	$476,431	$156,400	$684,273	$1,185,402	$5,117,854
Cash and sundries	$24,859,113	$301,254	$1,304,941	$231,999	$1,378,242	$233,809	$1,392,966	$3,034,429	$16,981,473
Proprietors and firm members	24			1			2	19	2
Salaried officials, clerks, etc.:									
Total number	1,289	32	28	11	29	24	83	163	919
Total salaries	$1,797,050	$56,457	$52,262	$15,174	$33,560	$27,817	$125,709	$233,049	$1,253,022
Officers of corporations—									
Number	288	9	4	3	5	7	22	50	188
Salaries	$741,742	$24,900	$15,533	$5,092	$7,900	$12,240	$57,250	$117,799	$501,028
General superintendents, managers, clerks, etc.—									
Total number	1,001	23	24	8	24	17	61	113	731
Total salaries	$1,055,308	$31,557	$36,729	$10,082	$25,660	$15,577	$68,459	$115,250	$751,994
Men—									
Number	895	22	20	8	19	14	47	99	666
Salaries	$1,001,444	$31,256	$33,945	$10,082	$22,540	$14,146	$61,341	$107,761	$720,373
Women—									
Number	106	1	4		5	3	14	14	65
Salaries	$53,864	$301	$2,784		$3,120	$1,431	$7,118	$7,489	$31,621
Wage-earners, including pieceworkers, and total wages:									
Greatest number employed at any one time during the year	6,598	270	371	155	385	126	503	977	3,811
Least number employed at any one time during the year	5,709	96	294	100	232	92	401	877	3,617
Average number	5,800	142	299	123	306	93	428	897	3,512
Total wages	$3,308,774	$82,611	$174,563	$87,964	$125,247	$49,095	$236,205	$526,609	$2,026,480
Men 16 years and over—									
Average number	5,708	142	299	119	273	92	416	874	3,493
Wages	$3,283,729	$82,611	$174,563	$86,116	$116,565	$48,735	$233,115	$520,181	$2,021,843
Women 16 years and over—									
Average number	91			4	33	1	12	22	19
Wages	$24,945			$1,848	$8,682	$360	$3,090	$6,328	$4,637
Children under 16 years—									
Average number	1							1	
Wages	$100							$100	
Average number of wage-earners, including pieceworkers, employed during each month:									
Men 16 years and over—									
January	5,761	109	316	117	284	110	414	846	3,565
February	5,743	120	316	120	284	112	420	839	3,532
March	5,810	159	323	123	284	113	420	856	3,532
April	5,835	164	316	117	258	116	422	870	3,572
May	5,798	164	297	121	273	83	416	878	3,566
June	5,743	145	305	118	231	83	412	865	3,584
July	5,743	104	319	147	232	83	432	861	3,565
August	5,577	99	337	133	274	87	394	880	3,373
September	5,658	156	299	130	290	84	405	887	3,407
October	5,633	172	264	132	288	80	408	903	3,386
November	5,646	158	255	121	300	77	421	908	3,406
December	5,549	154	241	49	278	76	428	895	3,428
Women 16 years and over—									
January	78			2	30	1	12	20	13
February	87			3	41	1	9	20	13
March	74			3	29	1	10	20	11
April	76			3	29	1	10	21	12
May	84			4	30	1	11	23	15
June	85			4	31	1	11	20	18
July	91			6	31	1	12	21	20
August	101			5	40	1	11	22	22
September	102			5	32	1	15	23	26
October	104			5	37	1	13	23	25
November	104			5	33	1	13	26	26
December	106			3	32	1	17	25	27
Children under 16 years—									
January	1							1	
February	1							1	
March	1							1	
April	1							1	
May	1							1	
June	1							1	
July	1							1	
August	1							1	
September	1							1	
October	1							1	
November	1							1	
December	1							1	
Miscellaneous expenses, total	$1,657,665	$43,062	$118,146	$19,096	$52,595	$49,975	$134,016	$234,664	$1,006,111
Rent of works	$9,812		$2,385			$150	$2,761	$3,146	$1,370
Taxes	$71,263	$495	$3,126	$2,443	$1,020	$1,841	$12,209	$11,740	$38,389
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$1,574,140	$42,567	$110,635	$16,653	$51,575	$47,784	$119,046	$219,528	$966,352
Contract work	$2,450		$2,000			$200		$250	
Materials used, total cost	$17,203,667	$412,129	$1,188,014	$519,399	$1,270,931	$152,046	$1,274,786	$2,516,461	$9,869,901

[1] Includes establishments distributed as follows: Alabama, 3; California, 5; Connecticut, 1; Delaware, 1; Indian Territory, 1; Iowa, 1; Kansas, 5; Kentucky, 1; Maine, 1; Maryland, 1; Massachusetts, 1; New Jersey, 10; Tennessee, 3; West Virginia, 8; Wisconsin, 1.

TABLE 148.—EXPLOSIVES—DETAILED SUMMARY, BY STATES: 1905—Continued.

	United States.	Illinois.	Indiana.	Michigan.	Missouri.	New York.	Ohio.	Pennsylvania.	All other states.
Products, total value	[1]$29,602,884	$711,626	$1,679,306	$791,278	$1,645,705	$348,118	$1,843,211	$4,012,857	$18,570,783
Power:									
Number of establishments reporting	123	5	7	4	4	5	16	39	43
Total horsepower	37,554	2,158	1,410	431	734	1,028	6,326	6,356	19,111
Owned—									
Engines—									
Steam—									
Number	375	7	13	16	11	14	38	105	171
Horsepower	21,636	1,383	1,025	181	388	285	3,027	4,596	10,751
Gas and gasoline—									
Number	15				1	2	3		9
Horsepower	427				5	59	68		295
Water wheels—									
Number	186			8		23	7	47	101
Horsepower	6,962			250		594	980	1,021	4,117
Water motors—									
Number	29								29
Horsepower	215								215
Electric motors—									
Number	428	25	18		20	6	73	15	271
Horsepower	7,889	775	355		116	90	2,251	657	3,645
Other power, horsepower	425		30		225			82	88
Rented—									
Electric motors—									
Number									
Horsepower									
Other kind, horsepower									
Furnished to other establishments, horsepower									

[1] Exclusive of 2 governmental establishments reporting products valued at $574,832.

TABLE 149.—VARNISHES—DETAILED

		United States.	California.	Connecticut.	Illinois.
1	Number of establishments	190	4	10	24
2	Capital, total	$19,702,955	$177,150	$368,955	$3,511,836
3	Land	$1,403,641	$15,000	$20,200	$348,676
4	Buildings	$2,651,344	$10,500	$47,709	$578,101
5	Machinery, tools, and implements	$1,649,785	$7,100	$39,718	$295,283
6	Cash and sundries	$13,998,185	$144,550	$261,328	$2,289,776
7	Proprietors and firm members	111	3	6	9
	Salaried officials, clerks, etc.:				
8	Total number	1,364	1	24	262
9	Total salaries	$2,023,162	$1,500	$44,200	$371,174
	Officers of corporations—				
10	Number	201	....	6	27
11	Salaries	$649,858	....	$10,700	$82,780
	General superintendents, managers, clerks, etc.—				
12	Total number	1,163	1	18	235
13	Total salaries	$1,373,304	$1,500	$33,500	$288,394
	Men—				
14	Number	905	1	17	195
15	Salaries	$1,252,909	$1,500	$32,800	$266,085
	Women—				
16	Number	258	....	1	40
17	Salaries	$120,395	....	$700	$22,309
	Wage-earners, including pieceworkers, and total wages:				
18	Greatest number employed at any one time during the year	2,009	20	58	271
19	Least number employed at any one time during the year	1,724	16	39	233
20	Average number	1,852	18	53	247
21	Total wages	$1,200,431	$15,997	$28,460	$176,088
	Men 16 years and over—				
22	Average number	1,767	18	51	238
23	Wages	$1,177,331	$15,997	$28,160	$173,525
	Women 16 years and over—				
24	Average number	77	....	1	6
25	Wages	$21,418	....	$50	$1,939
	Children under 16 years—				
26	Average number	8	....	1	3
27	Wages	$1,682	....	$250	$624
	Average number of wage-earners, including pieceworkers, employed during each month:				
	Men 16 years and over—				
28	January	1,782	18	50	234
29	February	1,784	18	50	234
30	March	1,792	18	50	236
31	April	1,799	18	50	237
32	May	1,799	17	53	234
33	June	1,773	18	53	235
34	July	1,751	18	51	235
35	August	1,725	18	53	235
36	September	1,737	18	51	242
37	October	1,755	17	51	244
38	November	1,760	19	50	245
39	December	1,747	19	50	245
	Women 16 years and over—				
40	January	77	....	1	6
41	February	78	....	1	6
42	March	80	....	1	6
43	April	83	....	1	6
44	May	79	....	1	6
45	June	87	....	1	6
46	July	79	....	1	6
47	August	70	....	1	6
48	September	68	....	1	6
49	October	73	....	1	6
50	November	76	....	1	6
51	December	74	....	1	6
	Children under 16 years—				
52	January	9	....	1	3
53	February	9	....	1	3
54	March	9	....	1	3
55	April	9	....	1	3
56	May	9	....	1	3
57	June	8	....	1	3
58	July	8	....	1	3
59	August	7	....	1	3
60	September	7	....	1	3
61	October	7	....	1	3
62	November	7	....	1	3
63	December	7	....	1	3
64	Miscellaneous expenses, total	$3,595,970	$1,814	$55,383	$657,495
65	Rent of works	$64,191	$600	$1,870	$5,560
66	Taxes	$79,121	$629	$2,202	$15,222
67	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$3,397,165	$585	$51,311	$635,213
68	Contract work	$55,493	....	....	$1,500
69	Materials used, total cost	$13,520,491	$109,424	$301,829	$2,132,672
70	Products, total value	$23,561,699	$148,406	$514,670	$3,840,753
	Power:				
71	Number of establishments reporting	107	1	6	20
72	Total horsepower	4,030	5	170	704
	Owned—				
	Engines—				
	Steam—				
73	Number	87	1	4	10
74	Horsepower	3,324	5	163	441
	Gas and gasoline—				
75	Number	15	....	....	5
76	Horsepower	202	....	....	73
	Water wheels—				
77	Number	....	....	....	....
78	Horsepower	....	....	....	....
	Water motors—				
79	Number	1	....	....	....
80	Horsepower	10	....	....	....
	Electric motors—				
81	Number	39	....	....	10
82	Horsepower	197	....	....	87
	Rented—				
	Electric motors—				
83	Number	41	....	2	12
84	Horsepower	256	....	7	103
85	Other kind, horsepower	41	....	....	....
86	Furnished to other establishments, horsepower	88	....	15	25

[1] Includes establishments distributed as follows: Louisiana, 1; Maryland, 2; Minnesota, 1; Rhode Island, 1; Virginia, 1; Wisconsin, 1.

SUMMARY, BY STATES: 1905.

Indiana.	Kentucky.	Massachusetts.	Michigan.	Missouri.	New Jersey.	New York.	Ohio.	Pennsylvania.	All other states.[1]	
5	3	10	5	10	22	39	26	24	7	1
$405,591	$261,887	$232,320	$2,061,445	$209,502	$3,415,805	$5,154,246	$1,809,547	$1,962,714	$131,957	2
$30,157	$6,504	$3,800	$38,380	$17,000	$247,672	$369,442	$97,368	$200,942	$8,500	3
$104,325	$39,908	$27,997	$297,835	$11,000	$535,597	$591,381	$221,556	$164,085	$21,350	4
$36,003	$15,762	$19,486	$112,185	$23,041	$337,428	$390,133	$148,146	$212,638	$12,862	5
$235,106	$199,713	$181,037	$1,613,045	$158,461	$2,295,108	$3,803,290	$1,342,477	$1,385,049	$89,245	6
		4	2	5	4	31	16	23	5	7
39	23	33	102	10	323	298	135	101	13	8
$53,213	$16,774	$48,536	$78,203	$19,192	$490,258	$504,453	$210,699	$171,696	$13,264	9
14	1	12	11	5	26	42	37	15	5	10
$19,800	$2,400	$30,000	$26,160	$14,000	$99,600	$177,146	$124,940	$54,332	$8,000	11
25	22	21	91	5	297	256	98	86	8	12
$33,413	$14,374	$18,536	$52,043	$5,192	$390,658	$327,307	$85,759	$117,364	$5,264	13
24	16	18	50	4	242	198	65	69	6	14
$33,049	$11,774	$17,172	$37,951	$4,812	$365,309	$297,058	$73,821	$107,094	$4,484	15
1	6	3	41	1	55	58	33	17	2	16
$364	$2,600	$1,364	$14,092	$380	$25,349	$30,249	$11,938	$10,270	$780	17
52	59	52	162	44	308	581	189	181	32	18
35	52	41	139	32	286	495	160	175	21	19
43	55	48	151	37	293	539	170	174	24	20
$24,198	$28,032	$25,703	$80,967	$22,919	$187,721	$358,407	$106,336	$129,739	$15,864	21
43	55	47	136	32	288	507	156	174	22	22
$24,198	$28,032	$25,403	$77,379	$21,839	$186,135	$349,024	$102,626	$129,739	$15,274	23
		1	15	5	5	28	14		2	24
		$300	$3,588	$1,080	$1,586	$8,575	$3,710		$590	25
						4				26
						$808				27
47	55	47	148	31	288	509	155	176	24	28
46	55	47	148	31	288	512	158	176	21	29
50	55	47	148	30	289	516	156	176	21	30
48	56	47	147	34	289	517	156	176	24	31
52	55	47	135	31	290	527	157	176	25	32
42	55	47	136	31	288	511	159	176	22	33
37	55	47	136	32	287	400	161	175	18	34
38	55	47	134	32	286	483	154	171	19	35
36	55	47	124	33	283	501	154	171	22	36
36	55	47	125	34	288	509	155	171	23	37
35	55	47	125	35	291	508	156	171	23	38
49	54	47	126	30	289	492	151	173	22	39
		1	15	5	5	29	11		4	40
		1	15	5	5	28	13		4	41
		1	15	5	5	30	14		3	42
		1	15	5	5	32	16		2	43
		1	15	5	5	27	18		1	44
		1	15	5	5	34	19		1	45
		1	15	4	5	29	17		1	46
		1	15	4	5	25	13			47
		1	15	6	5	24	10			48
		1	15	6	5	24	12		3	49
		1	15	6	5	25	14		3	50
		1	15	4	5	29	11		2	51
						5				52
						5				53
						5				54
						5				55
						5				56
						4				57
						4				58
						3				59
						3				60
						3				61
						3				62
						3				63
$91,010	$90,369	$88,291	$428,380	$23,948	$663,675	$978,813	$212,082	$274,044	$30,666	64
$372	$390	$6,925	$350	$3,447	$9,800	$24,183	$4,165	$5,441	$1,088	65
$2,700	$2,194	$1,147	$5,424	$1,028	$14,041	$15,729	$12,328	$5,922	$555	66
$87,938	$87,785	$80,219	$422,606	$19,473	$639,834	$937,901	$194,789	$210,488	$29,023	67
						$1,000	$800	$52,193		68
$301,631	$300,793	$215,554	$1,889,724	$148,864	$1,762,267	$3,649,561	$1,154,106	$1,405,859	$148,207	69
$522,475	$500,645	$413,884	$3,134,258	$255,412	$3,455,494	$6,399,574	$1,928,714	$2,208,148	$239,266	70
4	2	5	2	2	12	23	13	14	3	71
135	100	122	230	55	625	839	213	768	64	72
3	6	3	2	4	11	17	6	18	2	73
125	100	110	230	35	542	672	140	716	45	74
				1	1	3	1	4		75
				20	6	31	30	42		76
										77
										78
							1			79
							10			80
1					9	18		1		81
5					60	35		10		82
		3			3	11	7		3	83
		12			17	65	33		19	84
						36				85
5		30				18				86

TABLE 150.—DYESTUFFS AND EXTRACTS—

		United States.	Maine.	Massachusetts.
1	Number of establishments	98	3	16
2	Capital. total	$14,904,150	$20,922	$978,121
3	Land	$1,364,545	$500	$169,300
4	Buildings	$1,853,818	$4,000	$140,200
5	Machinery, tools, and implements	$3,565,327	$1,600	$108,643
6	Cash and sundries	$8,120,460	$14,822	$559,978
7	Proprietors and firm members	82	5	17
	Salaried officials, clerks, etc.:			
8	Total number	361	1	24
9	Total salaries	$608,790	$300	$29,052
	Officers of corporations—			
10	Number	63		3
11	Salaries	$191,887		$8,000
	General superintendents, managers, clerks, etc.—			
12	Total number	298	1	21
13	Total salaries	$416,903	$300	$21,052
	Men—			
14	Number	274		18
15	Salaries	$404,641		$19,760
	Women—			
16	Number	24	1	3
17	Salaries	$12,262	$300	$1,292
	Wage-earners, including pieceworkers, and total wages:			
18	Greatest number employed at any one time during the year	3,613	16	286
19	Least number employed at any one time during the year	2,178	7	130
20	Average number	2,707	9	150
21	Total wages	$1,264,492	$3,615	$84,311
	Men 16 years and over—			
22	Average number	2,678	6	149
23	Wages	$1,256,946	$3,021	$84,103
	Women 16 years and over—			
24	Average number	25	3	
25	Wages	$6,966	$594	
	Children under 16 years—			
26	Average number	4		1
27	Wages	$580		$208
	Average number of wage-earners, including pieceworkers, employed during each month:			
	Men 16 years and over—			
28	January	2,596	5	121
29	February	2,709	7	166
30	March	2,714	10	167
31	April	2,778	10	153
32	May	2,879	5	122
33	June	2,765	4	143
34	July	2,805	4	146
35	August	2,898	4	150
36	September	2,804	6	159
37	October	2,469	6	156
38	November	2,406	6	147
39	December	2,313	5	158
	Women 16 years and over—			
40	January	25	3	
41	February	25	3	
42	March	27	5	
43	April	28	6	
44	May	27	5	
45	June	24	2	
46	July	22		
47	August	22		
48	September	23	1	
49	October	27	5	
50	November	26	4	
51	December	24	2	
	Children under 16 years—			
52	January	4		2
53	February	3		1
54	March	3		1
55	April	3		1
56	May	4		1
57	June	5		1
58	July	5		1
59	August	5		1
60	September	5		1
61	October	4		1
62	November	4		1
63	December	3		
64	Miscellaneous expenses, total	$944,360	$9,254	$72,556
65	Rent of works	$22,253	$84	$8,225
66	Taxes	$55,386	$60	$6,808
67	Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$864,046	$9,110	$57,323
68	Contract work	$2,675		$200
69	Materials used, total cost	$6,829,340	$7,219	$616,581
70	Products, total value	$10,893,113	$30,051	$999,262
	Power:			
71	Number of establishments reporting	79		13
72	Total horsepower	18,310		1,205
	Owned—			
	Engines—			
	Steam—			
73	Number	192		21
74	Horsepower	17,348		1,170
	Gas and gasoline—			
75	Number	1		
76	Horsepower	4		
	Water wheels—			
77	Number	6		1
78	Horsepower	196		35
	Electric motors—			
79	Number	33		
80	Horsepower	639		
81	Other power, horsepower	76		
	Rented—			
	Electric motors—			
82	Number	2		
83	Horsepower	20		
84	Other kind, horsepower	27		

[1] Includes establishments distributed as follows: California, 2; Connecticut, 2; Florida, 2; Illinois, 2; Kentucky, 1; Michigan, 1; South Carolina, 1; Wisconsin, 1.

DETAILED SUMMARY, BY STATES: 1905.

New Jersey.	New York.	North Carolina.	Pennsylvania.	Rhode Island.	Tennessee.	Virginia.	West Virginia.	All other states.[1]	
14	9	6	8	8	5	12	5	12	1
$1,599,846	$3,547,048	$1,308,317	$3,031,823	$182,677	$1,113,241	$1,407,790	$295,668	$1,418,697	2
$179,344	$453,008	$215,565	$182,250	$1,100	$47,505	$74,509	$9,870	$31,594	3
$183,418	$357,837	$202,810	$183,918	$19,878	$266,602	$282,396	$15,050	$197,709	4
$285,801	$778,576	$385,021	$374,268	$43,360	$429,466	$417,603	$158,027	$582,962	5
$951,283	$1,957,627	$504,921	$2,291,387	$118,339	$369,668	$633,282	$112,721	$606,432	6
9	4	3	16	5	8	6	5	4	7
95	93	17	26	12	19	27	9	38	8
$192,030	$147,688	$31,833	$40,826	$21,183	$21,360	$45,055	$8,266	$71,197	9
8	12	7	3	3	4	9	5	8	10
$39,150	$44,537	$22,749	$10,000	$2,000	$8,100	$20,849	$6,152	$30,350	11
86	81	10	23	9	15	18	4	30	12
$152,880	$103,151	$9,084	$30,826	$19,183	$13,260	$24,206	$2,114	$40,847	13
78	76	10	21	8	14	17	4	28	14
$147,680	$101,065	$9,084	$30,410	$18,455	$12,900	$23,706	$2,114	$39,467	15
8	5		2	1	1	1		2	16
$5,200	$2,086		$416	$728	$360	$500		$1,380	17
280	603	569	254	78	334	601	98	494	18
212	376	329	151	54	243	302	47	327	19
250	519	435	203	70	259	424	82	306	20
$138,332	$316,678	$132,853	$105,264	$41,167	$102,652	$136,535	$28,294	$174,791	21
235	513	435	201	70	259	423	82	305	22
$133,832	$315,170	$132,853	$105,004	$41,167	$102.652	$136,423	$28,294	$174,427	23
15	6							1	24
$4,500	$1,508							$364	25
			2			1			26
			$260			$112			27
227	547	344	207	69	186	407	88	395	28
227	565	413	206	69	175	412	80	389	29
233	571	396	215	72	185	397	92	376	30
246	564	428	207	65	268	389	93	355	31
236	566	527	184	65	271	451	94	358	32
239	480	487	194	71	261	447	75	364	33
235	508	444	184	71	286	512	74	341	34
244	517	497	187	70	299	514	74	342	35
243	469	464	203	69	302	440	81	368	36
230	463	431	193	69	299	415	88	119	37
231	468	402	216	74	284	370	80	128	38
229	438	387	216	76	292	322	65	125	39
15	6							1	40
15	6							1	41
15	6							1	42
15	6							1	43
15	6							1	44
15	6							1	45
15	6							1	46
15	6							1	47
15	6							1	48
15	6							1	49
15	6							1	50
15	6							1	51
			2						52
			2						53
			2						54
			2						55
			2			1			56
			2			2			57
			2			2			58
			2			2			59
			2			2			60
			2			1			61
			2			1			62
			2			1			63
$167,443	$233,786	$83,478	$65,675	$45,037	$82,458	$70,138	$33,843	$80,692	64
$5,180	$860	$200	$720	$3,624		$920		$2,440	65
$7,886	$15,052	$3,049	$3,034	$306	$6,041	$5,664	$596	$6,890	66
$154,377	$217,874	$79,029	$61,921	$41,107	$76,417	$63,554	$31,972	$71,362	67
		$1,200					$1,275		68
$1,499,867	$1,651,653	$418,243	$629,499	$327,218	$362,252	$392,755	$119,280	$804,773	69
$2,176,253	$2,705,580	$636,628	$966,364	$513,006	$720,255	$736,622	$249,465	$1,159,627	70
13	7	5	5	6	5	11	5	9	71
1,023	2,431	2,160	2,731	294	2,541	4,400	435	1,090	72
17	27	15	14	8	15	49	8	18	73
987	2,257	2,060	2,420	280	2,396	4,365	435	978	74
1									75
4									76
				1		2		2	77
				14		35		112	78
1	6	1	22		3				79
5	78	100	311		145				80
	76								81
	2								82
	20								83
27									84

TABLE 151.—SULPHURIC, NITRIC, AND MIXED ACIDS—DETAILED SUMMARY, BY STATES: 1905.

	United States.	California.	New York.	Pennsylvania.	All other states.[1]
Number of establishments	32	4	7	5	16
Capital, total	$12,761,920	$1,524,764	$3,666,375	$899,589	$6,671,192
Land	$1,431,440	$105,045	$321,153	$124,562	$880,680
Buildings	$2,808,457	$131,200	$513,327	$165,508	$1,998,422
Machinery, tools, and implements	$4,960,647	$601,956	$1,800,552	$406,431	$2,151,708
Cash and sundries	$3,561,376	$686,563	$1,031,343	$203,088	$1,640,382
Proprietors and firm members	2	...	...	...	2
Salaried officials, clerks, etc.:					
Total number	308	21	69	38	180
Total salaries	$556,106	$43,670	$159,437	$57,431	$295,568
Officers of corporations—					
Number	37	3	6	13	15
Salaries	$71,775	$12,000	$16,080	$14,760	$28,935
General superintendents, managers, clerks, etc.—					
Total number	271	18	63	25	165
Total salaries	$484,331	$31,670	$143,357	$42,671	$266,633
Men—					
Number	261	14	62	24	161
Salaries	$479,232	$29,220	$142,421	$42,191	$265,400
Women—					
Number	10	4	1	1	4
Salaries	$5,099	$2,450	$936	$480	$1,233
Wage-earners, including pieceworkers, and total wages:					
Greatest number employed at any one time during the year	3,023	303	834	219	1,667
Least number employed at any one time during the year	1,888	172	670	130	916
Average number	2,447	237	726	155	1,329
Total wages	$1,505,406	$158,092	$436,819	$84,670	$825,825
Men 16 years and over—					
Average number	2,443	237	723	154	1,329
Wages	$1,504,359	$158,092	$435,944	$84,498	$825,825
Women 16 years and over—					
Average number	1	...	1	...	...
Wages	$250	...	$250	...	...
Children under 16 years—					
Average number	3	...	2	1	...
Wages	$797	...	$625	$172	...
Average number of wage-earners employed during each month:					
Men 16 years and over—					
January	2,296	265	573	146	1,312
February	2,390	261	580	145	1,404
March	2,636	255	794	154	1,433
April	2,510	253	775	157	1,325
May	2,429	214	730	176	1,309
June	2,425	195	754	158	1,318
July	2,236	218	743	143	1,132
August	2,399	241	726	159	1,273
September	2,451	253	741	163	1,294
October	2,499	246	746	155	1,352
November	2,516	240	759	147	1,370
December	2,505	203	755	145	1,402
Women 16 years and over—					
January	...	...	...	...	...
February	...	...	...	...	...
March	2	...	2	...	...
April	2	...	2	...	...
May	1	...	1	...	...
June	1	...	1	...	...
July	1	...	1	...	...
August	1	...	1	...	...
September	1	...	1	...	...
October	1	...	1	...	...
November	1	...	1	...	...
December	1	...	1	...	...
Children under 16 years—					
January	...	...	...	...	...
February	...	...	...	...	...
March	2	...	2	...	...
April	2	...	2	...	...
May	2	...	2	...	...
June	2	...	2	...	...
July	8	...	2	6	...
August	8	...	2	6	...
September	3	...	3	...	...
October	3	...	3	...	...
November	3	...	3	...	...
December	3	...	3	...	...
Miscellaneous expenses, total	$712,953	$44,401	$201,566	$35,045	$431,941
Rent of works	$41,512	...	$10,000	...	$31,512
Taxes	$60,511	$2,785	$15,697	$6,619	$35,410
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$603,091	$41,616	$175,869	$28,426	$357,180
Contract work	$7,839	...	...	...	$7,839
Materials used, total cost	$4,972,838	$596,469	$1,302,079	$265,702	$2,808,588
Products, total value	$9,052,646	$915,473	$2,711,692	$560,594	$4,864,887
Power:					
Number of establishments reporting	31	4	7	4	16
Total horsepower	5,241	616	1,240	1,031	2,354
Owned—					
Engines—					
Steam—					
Number	143	6	34	16	87
Horsepower	3,645	276	835	180	2,354
Gas and gasoline—					
Number	7	3	...	4	...
Horsepower	161	125	...	36	...
Water wheels—					
Number	...	...	...	...	...
Horsepower	...	...	...	...	...
Water motors—					
Number	...	...	...	...	...
Horsepower	...	...	...	...	...
Electric motors—					
Number	13	...	...	13	...
Horsepower	125	...	...	125	...
Other power, horsepower	895	15	190	690	...
Rented—					
Electric motors—					
Number	32	18	14	...	...
Horsepower	415	200	215	...	...

[1] Includes establishments distributed as follows: Alabama, 2; Colorado, 1; Connecticut, 2; Indiana, 1; Kansas, 1; Maryland, 2; New Jersey, 4; Ohio, 1; Rhode Island, 1; Virginia, 1.

Table 152.—WOOD DISTILLATION—DETAILED SUMMARY, BY STATES: 1905.

	United States.	Florida.	Georgia.	Michigan.	New York.	North Carolina.	Pennsylvania.	South Carolina.	All other states.[1]
Number of establishments	141	4	9	9	32	7	63	5	12
Capital, total	$10,506,979	$114,080	$269,902	$1,333,999	$3,199,359	$139,845	$5,009,357	$44,310	$396,127
Land	$761,402	$9,250	$12,000	$16,345	$217,406	$12,855	$476,425	$750	$16,371
Buildings	$1,311,702	$11,500	$23,100	$173,000	$414,657	$18,900	$607,866	$5,700	$56,979
Machinery, tools, and implements	$4,394,964	$85,000	$188,847	$838,714	$889,035	$93,475	$2,073,366	$26,950	$199,577
Cash and sundries	$4,038,911	$8,330	$45,955	$305,940	$1,678,261	$14,615	$1,851,700	$10,910	$123,200
Proprietors and firm members	82	2	2	4	19	6	42	4	3
Salaried officials, clerks, etc.:									
Total number	301	8	15	32	66	8	135	5	32
Total salaries	$297,528	$9,800	$12,472	$32,360	$93,046	$5,840	$110,661	$2,912	$30,437
Officers of corporations—									
Number	77	3	6	7	9	1	43	2	6
Salaries	$114,494	$6,500	$6,000	$7,980	$40,998	$2,000	$43,261	$1,200	$6,555
General superintendents, managers, clerks, etc.—									
Total number	224	5	9	25	57	7	92	3	26
Total salaries	$183,034	$3,300	$6,472	$24,380	$52,048	$3,840	$67,400	$1,712	$23,882
Men—									
Number	212	5	9	24	52	6	90	3	23
Salaries	$177,758	$3,300	$6,472	$24,200	$49,323	$3,340	$66,925	$1,712	$22,486
Women—									
Number	12			1	5	1	2		3
Salaries	$5,276			$180	$2,725	$500	$475		$1,396
Wage-earners, including pieceworkers, and total wages:									
Greatest number employed at any one time during the year	2,835	48	88	339	542	67	1,551	40	160
Least number employed at any one time during the year	2,134	38	63	274	494	47	1,117	20	81
Average number	2,272	34	54	291	489	51	1,249	21	83
Total wages	$1,066,786	$13,797	$16,653	$156,125	$218,031	$16,469	$597,743	$4,222	$43,746
Men 16 years and over—									
Average number	2,272	34	54	291	489	51	1,249	21	83
Wages	$1,066,786	$13,797	$16,653	$156,125	$218,031	$16,469	$597,743	$4,222	$43,746
Average number of wage-earners, including pieceworkers, employed during each month:									
Men 16 years and over—									
January	2,399	20	58	277	512	53	1,387	18	74
February	2,374	20	50	281	525	54	1,350	20	74
March	2,381	20	46	330	517	50	1,323	20	75
April	2,342	36	51	307	493	48	1,305	21	81
May	2,256	36	40	303	478	48	1,243	26	82
June	2,164	34	42	294	454	48	1,175	35	82
July	2,052	34	37	294	440	50	1,100	14	83
August	2,088	34	44	314	449	50	1,109	14	74
September	2,182	44	75	274	476	51	1,170	17	75
October	2,286	44	73	254	500	53	1,233	27	102
November	2,392	43	65	273	521	55	1,298	26	111
December	2,348	43	67	291	503	52	1,295	14	83
Miscellaneous expenses, total	$631,437	$7,554	$10,960	$85,547	$233,347	$6,630	$229,079	$2,176	$56,144
Rent of works	$3,859	$120	$60		$300		$1,758	$200	$1,421
Taxes	$47,010	$368	$513	$11,219	$14,827	$890	$16,970	$211	$2,012
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$558,598	$7,066	$10,387	$52,828	$218,220	$5,740	$209,881	$1,765	$52,711
Contract work	$21,970			$21,500			$470		
Materials used, total cost	$4,847,770	$31,127	$35,857	$350,854	$2,479,941	$26,764	$1,708,505	$6,809	$207,913
Products, total value	$7,813,483	$85,240	$80,674	$738,254	$3,357,087	$74,531	$3,092,687	$14,418	$370,592
Power:									
Number of establishments reporting	112	4	9	7	31	3	47	5	6
Total horsepower	4,634	135	460	366	706	125	2,311	162	369
Owned—									
Engines—									
Steam—									
Number	154	4	12	15	36	5	67	8	7
Horsepower	3,744	135	460	354	578	125	1,561	162	369
Gas and gasoline—									
Number	13						13		
Horsepower	287						287		
Water wheels—									
Number	35				12		23		
Horsepower	370				106		264		
Water motors—									
Number	1				1				
Horsepower	2				2				
Electric motors—									
Number	2						2		
Horsepower	14						14		
Other power, horsepower	185						185		
Rented—									
Electric motors—									
Number	2			2					
Horsepower	12			12					
Other kind, horsepower	20				20				

[1]Includes establishments distributed as follows: Alabama, 1; Connecticut, 1; Kentucky, 1; Louisiana, 2; Massachusetts, 2; Minnesota, 1; Mississippi, 1; Vermont, 2; Washington, 1.

TABLE 153.—OIL, ESSENTIAL—DETAILED SUMMARY, BY STATES: 1905.

	United States.	Connecticut.	Indiana.	Michigan.	New York.	Pennsylvania.	Virginia.	All other states.[1]
Number of establishments	52	[illegible]	13	6	5	9	4	6
Capital, total	$723,004	$244,787	$14,625	$173,725	$41,452	$13,080	$5,336	$229,999
Land	$74,035	$31,050	$625	$2,325	$4,525	$200	$110	$35,200
Buildings	$140,755	$38,300	$1,425	$12,600	$9,000	$2,800	$330	$76,300
Machinery, tools, and implements	$157,014	$59,500	$2,575	$8,400	$21,284	$5,975	$2,100	$57,180
Cash and sundries	$351,200	$115,937	$10,000	$150,400	$6,643	$4,105	$2,796	$61,319
Proprietors and firm members	68	10	16	18	5	8	7	4
Salaried officials, clerks, etc.:								
Total number	37	11		5	4	2		15
Total salaries	$40,002	$9,724		$8,600	$3,832	$900		$16,946
Officers of corporations—								
Number	7				3			4
Salaries	$9,650				$3,000			$6,650
General superintendents, managers, clerks, etc.—								
Total number	30	11		5	1	2		11
Total salaries	$30,352	$9,724		$8,600	$832	$900		$10,296
Men—								
Number	24	9		4	1	[illegible]		8
Salaries	$26,756	$8,024		$8,000	$832	$900		$9,000
Women—								
Number	[illegible]	2		1				3
Salaries	$3,596	$1,700		$600				$1,296
Wage-earners, including pieceworkers, and total wages:								
Greatest number employed at any one time during the year	272	70	37	39	25	14	13	74
Least number employed at any one time during the year	190	45	24	31	13	12	9	56
Average number	132	33	3	13	16	5	4	58
Total wages	$69,711	$16,396	$1,369	$8,000	$7,415	$2,000	$971	$33,560
Men 16 years and over—								
Average number	127	33	3	13	15	5	4	54
Wages	$68,370	$16,396	$1,369	$8,000	$7,103	$2,000	$971	$32,531
Women 16 years and over—								
Average number	5				1			[illegible]
Wages	$1,341				$312			$1,029
Average number of wage-earners, including pieceworkers, employed during each month:								
Men 16 years and over—								
January	158	63		4	18	15		58
February	154	61		6	17	12		58
March	158	60		7	18	12	3	58
April	130	27		11	20	6	8	58
May	105	12		9	19		8	57
June	87	6		9	18		8	46
July	88	4	3	17	13			51
August	136	4	29	39	13			51
September	112	4	4	39	13		4	48
October	120	46		6	12	3	6	47
November	132	51		5	9	3	6	58
December	144	58		4	10	9	5	58
Women 16 years and over—								
January	10				2			8
February	10				2			8
March	10				2			8
April	11				2			9
May	11				2			9
June	8				2			6
July								
August								
September								
October								
November								
December								
Miscellaneous expenses, total	$78,886	$40,494	$1,955	$2,019	$10,088	$1,531	$87	$22,712
Rent of works	$1,442	$135			$750	$64	$12	$481
Taxes	$3,897	$324	$223	$545	$238	$35	$38	$2,494
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$73,547	$40,035	$1,732	$1,474	$9,100	$1,432	$37	$19,737
Materials used, total cost	$1,110,470	$195,471	$12,962	$166,188	$453,747	$11,874	$3,923	$266,305
Products, total value	$1,464,662	$289,883	$25,470	$240,215	$502,014	$22,421	$9,856	$374,803
Power:								
Number of establishments reporting	34	9	7	2	[illegible]	5	4	5
Total horsepower	849	430	130	11	59	46	53	120
Owned—								
Engines—								
Steam—								
Number	36	14	7	2	1	5	4	3
Horsepower	709	360	130	11	12	46	53	97
Gas and gasoline—								
Number	2				1			1
Horsepower	28				35			3
Water wheels—								
Number	3	3						
Horsepower	70	70						
Rented—								
Electric motors—								
Number	1							1
Horsepower	20							20
Other kind, horsepower	12				12			

[1] Includes establishments distributed as follows: California, 1; Massachusetts, 1; New Hampshire, 1; New Jersey, 1; Wisconsin, 2.

TABLE 154.—BONE, IVORY, AND LAMP BLACK—DETAILED SUMMARY, UNITED STATES: 1905.

	United States.
Number of establishments	25
Capital, total	$1,663,143
Land	$179,589
Buildings	$558,864
Machinery, tools, and implements	$474,154
Cash and sundries	$450,536
Proprietors and firm members	11
Salaried officials, clerks, etc.:	
Total number	47
Total salaries	$48,490
Officers of corporations—	
Number	22
Salaries	$22,102
General superintendents, managers, clerks, etc.—	
Total number	25
Total salaries	$26,388
Men—	
Number	21
Salaries	$24,840
Women—	
Number	4
Salaries	$1,548
Wage-earners, including pieceworkers, and total wages:	
Greatest number employed at any one time during the year	235
Least number employed at any one time during the year	181
Wage-earners, including pieceworkers, and total wages—Cont'd.	
Average number	200
Wages	$105,159
Men 16 years and over—	
Average number	192
Wages	$103,699
Women 16 years and over—	
Average number	7
Wages	$1,360
Children under 16 years—	
Average number	1
Wages	$100
Miscellaneous expenses, total	$69,454
Rent of works	$6,290
Taxes	$5,866
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$57,298
Materials used, total cost	$203,396
Components of products	$134,162
Fuel	$13,755
Mill supplies	$2,840
All other materials	$51,215
Freight	$1,424
Products, total value	$647,717

TABLE 155.—CHEMICALS—DETAILED SUMMARY, MATERIALS AND PRODUCTS: 1905.

	United States.
Materials used, total cost	$42,062,611
Bauxite—	
Tons	46,383
Cost	$370,169
Limestone—	
Tons	755,255
Cost	$936,974
Phosphate rock—	
Tons	9,399
Cost	$61,053
Pyrites—	
Tons	136,360
Cost	$778,209
Sulphur—	
Tons	28,482
Cost	$591,700
Acids—	
Sulphuric—	
Tons	104,489
Cost	$945,486
Nitric—	
Pounds	6,136,867
Cost	$320,818
Mixed—	
Pounds	3,467,726
Cost	$156,605
Acetate of lime—	
Tons	12,310
Cost	$364,847
Argols, cost	$2,013,400
Ammonia—	
Aqua—	
Pounds	25,251,853
Cost	$832,076
Sulphate—	
Pounds	11,351,100
Cost	$356,109
Alcohol—	
Grain—	
Gallons	187,389
Cost	$449,604
Wood—	
Gallons	601,077
Cost	$367,223
Bones, cost	$263,264
Coal tar—	
Gallons	160,000
Cost	$4,226
Common salt—	
Tons	183,241
Cost	$473,913
Cotton—	
Pounds	97,000
Cost	$10,900
Glycerin—	
Pounds	21,482,084
Cost	$1,933,254
Lead—	
Tons	514
Cost	$54,213
Lime—	
Bushels	5,642,303
Cost	$656,316
Nitrate of potash—	
Tons	673
Cost	$53,000
Nitrate of soda—	
Tons	17,615
Cost	$751,968
Materials used—Continued.	
Potash salts, cost	$630,612
Sodium—	
Pounds	34,000
Cost	$430
Tallow and fats, cost	$231,026
Wood ashes—	
Bushels	193,000
Cost	$24,125
All other components of products, cost	$19,763,601
Fuel	$3,909,719
Rent of power and heat	$631,870
Mill supplies	$281,420
All other materials	$3,296,146
Freight	$548,335
Products, total value	$75,222,249
Acids—	
Total value	$7,583,059
Tartaric—	
Pounds	2,684,000
Value	$680,280
Acetic—	
Pounds	27,001,322
Value	$537,542
Other, value	$6,365,237
Sodas, total value	$16,858,929
Soda ash—	
Tons	518,789
Value	$8,202,292
Sal soda—	
Tons	56,870
Value	$792,248
Bicarbonate of soda—	
Tons	68,867
Value	$1,135,610
Caustic soda—	
Tons	80,159
Value	$2,924,182
Borax—	
Tons	20,882
Value	$2,122,808
Other soda products, value	$1,681,789
Potashes—	
Pounds	5,113,706
Value	$563,489
Alums—	
Pounds	169,032,501
Value	$2,126,612
Coal tar products, total value	$844,817
Coal tar distillery products, value	$340,641
Chemicals made from coal tar distillery products, value	$504,176
Cyanides, total value	$1,179,104
Potassium cyanide—	
Pounds	78,584
Value	$17,438
Yellow prussiate of potash—	
Pounds	5,027,264
Value	$683,277
Other cyanides, value	$478,389
Bleaching materials, total value	$777,750
Hypochlorites—	
Tons	6,098
Value	$162,671
Other bleaching agents, value	$615,079
Electro-chemical products, value	$5,896,632
Plastics, total value	$4,755,761
Pyroxylin plastics, value	$2,857,093
All other products in this group, value	$1,898,668

TABLE 155.—CHEMICALS—DETAILED SUMMARY, MATERIALS AND PRODUCTS: 1905—Continued.

	United States.
Products—Continued.	
Compressed and liquefied gases, total value	$2,787,689
Anhydrous ammonia, value	$1,173,184
Carbon dioxide, value	$1,343,966
All other compressed and liquefied gases, value	$270,539
Fine chemicals, total value	$9,145,853
Alkaloids—	
Ounces	4,949,525
Value	$2,925,789
Gold salts—	
Ounces	59,969
Value	$449,864
Silver salts—	
Ounces	1,743,882
Value	$683,761
Platinum salts—	
Ounces	19,068
Value	$175,682
Chloroform—	
Pounds	616,670
Value	$165,604
Ether—	
Pounds	660,783
Value	$334,935
Acetone—	
Pounds	1,300,395
Value	$161,320
Vanillin—	
Pounds	45,801
Value	$165,044
All other, value	$4,083,854
Products—Continued.	
Chemicals not otherwise specified, total value	$16,959,484
Glycerin—	
Pounds	18,791,997
Value	$2,345,205
Cream of tartar—	
Pounds	11,553,660
Value	$2,263,872
Epsom salts—	
Pounds	15,935,837
Value	$145,801
Blue vitriol—	
Pounds	50,100
Value	$2,500
Copperas—	
Pounds	8,815,059
Value	$28,061
Phosphates of soda—	
Pounds	12,018,815
Value	$243,822
Tin salts—	
Pounds	9,573,719
Value	$904,679
All other, value	$11,025,544
Miscellaneous, value	$5,743,070
Products consumed:	
Acids—	
Sulphuric, tons	95,768
Nitric, pounds	4,976,461
Ether, pounds	1,868
Pyroxylin, pounds	2,926,266
All other products consumed, pounds	3,135,902,134

TABLE 156.—PAINTS—DETAILED SUMMARY, MATERIALS AND PRODUCTS: 1905.

	United States.
Materials used, total cost	$46,306,183
Limestone and cliffstone—	
Tons	13,520
Cost	$24,841
Gums—	
Pounds	4,612,369
Cost	$624,463
Pig lead—	
Tons	128,513
Cost	$11,119,402
White lead, dry—	
Pounds	57,569,584
Cost	$2,835,105
White lead, in oil—	
Pounds	326,155
Cost	$15,131
Zinc white—	
Pounds	63,352,603
Cost	$2,731,765
All other pigments—	
Pounds	288,723,657
Cost	$4,469,836
Lime—	
Bushels	3,538
Cost	$1,072
Coal tar colors—	
Pounds	645,499
Cost	$243,794
Oils—	
Linseed—	
Gallons	16,641,795
Cost	$6,222,169
Cottonseed—	
Gallons	1,000
Cost	$400
All other—	
Gallons	2,146,960
Cost	$478,728
Alcohol (grain)—	
Gallons	6,613
Cost	$15,971
Alcohol (wood)—	
Gallons	48,708
Cost	$46,025
All other solvents—	
Gallons	8,919,937
Cost	$2,631,616
Sulphuric acid—	
Tons	1,337
Cost	$28,062
All other components of products—	
Pounds	232,687,321
Cost	$7,785,634
Fuel	$707,680
Rent of power and heat	$89,026
Mill supplies	$106,527
All other materials	$5,953,739
Freight	$175,197
Products, total value	$67,277,910
Pigments, total value	$11,650,396
White lead, dry—	
Pounds	62,395,868
Value	$2,877,109
Oxides of lead—	
Pounds	49,710,330
Value	$2,590,472
Products—Continued.	
Lamp and other blacks—	
Pounds	757,244
Value	$49,869
Barytes—	
Pounds	22,279,980
Value	$134,074
Fine colors—	
Pounds	7,780,330
Value	$1,076,853
Iron oxides and other earth colors—	
Pounds	47,322,913
Value	$327,994
Dry colors—	
Pounds	84,308,151
Value	$3,678,642
Pulp colors, sold moist—	
Pounds	25,351,515
Value	$915,383
Paints, total value	$39,609,396
White lead, in oil—	
Pounds	216,460,087
Value	$11,226,889
Paints in oil, in paste—	
Pounds	124,948,405
Value	$8,298,483
Paints already mixed for use—	
Gallons	21,822,755
Value	$20,084,024
Varnishes and japans, total value	$2,568,800
Oil and turpentine varnishes—	
Gallons	2,236,024
Value	$1,701,151
Alcohol varnishes—	
Gallons	85,675
Value	$134,221
Pyroxylin varnishes—	
Gallons	3,892
Value	$4,003
Liquid dryers, japans, and lacquers, value	$499,411
All other products in this group, value	$230,014
Fillers, total value	$1,847,311
Liquid—	
Gallons	541,146
Value	$415,915
Paste, dry and putty—	
Pounds	65,982,997
Value	$1,431,396
Water paints and kalsomine, total value	$934,037
Dry or in paste—	
Pounds	27,932,447
Value	$924,807
Mixed for use—	
Gallons	123,400
Value	$9,230
All other products, value	$10,667,970
Products consumed:	
White lead, dry, pounds	122,288,484
Lead oxides, pounds	13,589,147
Linseed oil, gallons	325,145
Varnishes, gallons	1,099,908
Drying japans and dryers, gallons	960,679
Collodion and other cellulose nitrate solutions, gallons	1,570,642
All other products consumed, pounds	1,764,281

TABLE 157.—FERTILIZERS—DETAILED SUMMARY, MATERIALS AND PRODUCTS: 1905.

	United States.
Materials used, total cost	$39,343,914
Fish—	
Thousands	923,305
Cost	$880,142
Kainit—	
Tons	190,493
Cost	$1,891,073
Limestone—	
Tons	20,281
Cost	$10,731
Phosphate rock—	
Tons	888,571
Cost	$4,244,554
Pyrites—	
Tons	342,962
Cost	$2,020,759
Sulphur—	
Tons	4,210
Cost	$92,234
Lime—	
Bushels	22,131
Cost	$3,475
Potash salts—	
Tons	122,107
Cost	$3,606,701
Nitrate of potash—	
Tons	1,160
Cost	$39,039
Nitrate of soda—	
Tons	42,213
Cost	$1,760,432
Wood ashes—	
Bushels	17,083
Cost	$2,050
Sulphuric acid—	
Tons	197,865
Cost	$1,084,304
Acid phosphate—	
Tons	320,559
Cost	$2,912,010
Ammoniates—	
Tons	125,888
Cost	$2,445,051
Ammonium sulphate—	
Tons	10,540
Cost	$600,856
Common salt—	
Tons	2,406
Cost	$13,245
Materials used—Continued.	
Cottonseed and cottonseed meal, cost	$2,376,448
Bones, tankage, and offal, cost	$5,094,149
All other components of products, cost	$5,591,236
Fuel	$953,490
Rent of power and heat	$33,737
Mill supplies	$124,962
All other materials	$3,193,992
Freight	$369,244
Products, total value	$56,632,853
Fertilizers, total value	$50,506,294
Superphosphates—	
From minerals, bones, etc.—	
Tons	766,338
Value	$7,515,257
Ammoniated—	
Tons	775,987
Value	$12,901,057
Complete—	
Tons	1,329,149
Value	$25,673,511
All other—	
Tons	396,303
Value	$4,416,469
Sulphuric acid, total value	$194,578
66° Baumé—	
Tons	337
Value	$9,251
50° Baumé—	
Tons	23,997
Value	$185,327
Other acids—	
Tons	45,689
Value	$241,506
Epsom salts—	
Pounds	1,712,698
Value	$13,716
Soda products—	
Tons	3,241
Value	$36,935
All other products, value	$5,639,824
Products consumed:	
Sulphuric acid, tons	692,904
Acid phosphate, tons	884,211
All other products, tons	99,785

TABLE 158.—EXPLOSIVES—DETAILED SUMMARY, MATERIALS AND PRODUCTS: 1905.

	United States.
Materials used, total cost	$17,203,667
Wood—	
Cords	5,628
Cost	$38,780
Pyrites—	
Tons	12,256
Cost	$67,261
Sulphur—	
Tons	[1] 19,574
Cost	[2] $507,469
Charcoal—	
Bushels	1,251,749
Cost	$232,048
Nitrate of soda—	
Tons	133,034
Cost	$5,608,557
Nitrate of potash—	
Tons	2,336
Cost	$175,258
Chloride of potassium—	
Tons	1,329
Cost	$51,831
Cotton—	
Pounds	3,749,293
Cost	$369,228
Sulphuric acid—	
Tons	18,298
Cost	$247,301
Nitric acid—	
Pounds	2,699,500
Cost	$122,047
Mixed acid—	
Pounds	105,552,404
Cost	$3,093,429
Glycerin—	
Pounds	24,561,527
Cost	$3,129,665
Aqua ammonia—	
Pounds	997,830
Cost	$46,916
Alcohol—	
Gallons	850,560
Cost	$231,353
Materials used—Continued.	
All other components of products, cost	$1,516,859
Fuel	$509,860
Rent of power and heat	$175
Mill supplies	$128,291
All other materials	$973,010
Freight	$154,329
Products, total value	[3] $29,602,884
Explosives, total value	$27,695,963
Gunpowder (black)—	
Pounds	10,383,944
Value	$1,541,483
Blasting powder—	
Kegs	8,217,448
Value	$7,377,977
Nitroglycerin—	
Pounds	7,935,936
Value	$1,620,117
Dynamite—	
Pounds	130,920,829
Value	$12,900,193
Guncotton or pyroxylin (sold as such)—	
Pounds	293,970
Value	$167,322
Smokeless powder—	
Pounds	6,009,855
Value	$3,938,073
All other explosives, value	$150,798
All other products, value	$1,906,921
Products consumed:	
Saltpeter, pounds	3,559,376
Nitroglycerin, pounds	44,077,828
Sulphuric acid, tons	30,994
Nitric acid, tons	18,988
Charcoal, bushels	1,156,918
Ether, pounds	2,740,286
Nitrate of ammonia, pounds	2,863,857
All other products consumed, pounds	6,299,317

[1] Includes 1,004 tons of coal and guhr in California.
[2] Includes $5,649 cost of coal and guhr in California.
[3] Exclusive of 2 governmental establishments reporting products valued at $574,832.

TABLE 159.—VARNISHES—DETAILED SUMMARY, MATERIALS AND PRODUCTS: 1905.

	United States.
Materials used, total cost	$13,520,491
Gums—	
Pounds	33,091,256
Cost	$3,704,161
White lead, dry—	
Pounds	2,608,870
Cost	$131,658
White lead, in oil—	
Pounds	15,859
Cost	$1,204
Zinc white—	
Pounds	1,992,900
Cost	$79,750
All other pigments—	
Pounds	21,640,280
Cost	$521,812
Lime—	
Bushels	12
Cost	$6
Coal tar colors—	
Pounds	7,433
Cost	$3,223
Oils—	
Linseed—	
Gallons	3,765,309
Cost	$1,647,101
Cottonseed—	
Gallons	4,800
Cost	$1,440
All other—	
Gallons	1,106,534
Cost	$531,089
Alcohol (grain)—	
Gallons	51,070
Cost	$118,433
Alcohol (wood)—	
Gallons	1,217,008
Cost	$693,402
All other solvents—	
Gallons	14,276,709
Cost	$3,458,939
Pyroxylin—	
Pounds	52,530
Cost	$40,953
Mixed acid—	
Tons	26
Cost	$1,046
All other components of products, cost	$919,300
Fuel	$125,818
Rent of power and heat	$7,497
Mill supplies	$14,307
All other materials	$1,369,608
Freight	$149,744

	United States.
Products, total value	$23,561,699
Pigments, total value	$315,410
Oxides of lead—	
Pounds	24,000
Value	$1,300
Barytes—	
Pounds	20,000
Value	$100
Iron oxides and other earth colors—	
Pounds	1,023,065
Value	$3,422
Dry colors—	
Pounds	6,105,600
Value	$310,588
Paints, total value	$780,663
White lead, in oil—	
Pounds	36,363
Value	$2,000
Paints in oil, in paste—	
Pounds	6,992,059
Value	$414,700
Paints already mixed for use—	
Gallons	556,265
Value	$363,963
Varnishes and japans, total value	$20,302,686
Oil and turpentine varnishes—	
Gallons	14,926,695
Value	$14,001,846
Alcohol varnishes—	
Gallons	1,467,887
Value	$2,046,492
Pyroxylin varnishes—	
Gallons	144,428
Value	$158,160
Liquid dryers, japans, and lacquers, value	$2,846,944
All other products of this group, value	$1,249,244
Fillers, total value	$497,325
Liquid—	
Gallons	510,002
Value	$369,702
Paste and dry putty—	
Pounds	2,778,177
Value	$127,623
All other products, value	$1,665,615
Products consumed:	
Linseed oil, gallons	30,000
Varnishes, gallons	102,766
Drying japans and dryers, gallons	28,300
Collodion and other cellulose nitrate solutions, gallons	5,800
Pyroxylin and other cellulose nitrates, pounds	12,000

TABLE 160.—DYESTUFFS AND EXTRACTS—DETAILED SUMMARY, MATERIALS AND PRODUCTS: 1905.

	United States.
Materials used, total cost	$6,829,340
Wood—	
Cords	258,981
Cost	$795,786
Bark—	
Tons	103,119
Cost	$948,997
Logwood—	
Tons	37,733
Cost	$678,590
Sumac leaves—	
Tons	4,456
Cost	$93,519
Palmetto root—	
Tons	4,350
Cost	$11,500
Indigo, natural—	
Pounds	96,500
Cost	$82,000
Coal tar colors—	
Pounds	1,802,826
Cost	$293,573
Sulphuric acid—	
Pounds	3,557,884
Cost	$49,779
Other acids—	
Pounds	5,301,413
Cost	$71,393
All other components of products, cost	$2,822,676
Fuel	$386,249
Rent of power and heat	$976
Mill supplies	$53,799
All other materials	$469,835
Freight	$70,668
Products, total value	$10,893,113
Dyestuffs—	
Natural—	
Pounds	8,172,552
Value	$233,935
Artificial—	
Pounds	4,600,462
Value	$1,764,454
Mordants—	
Pounds	733,245
Value	$64,656
Iron liquor—	
Pounds	1,860,744
Value	$30,757
Turkey red oil—	
Pounds	3,022,470
Value	$159,666

	United States.
Products—Continued.	
Logwood extract—	
Pounds	29,799,606
Value	$1,472,047
Ground bark—	
Pounds	38,001,017
Value	$249,101
Ground and chipped wood—	
Pounds	9,999,906
Value	$95,237
Ground sumac—	
Pounds	5,061,333
Value	$65,190
Extracts—	
Sumac—	
Pounds	4,093,619
Value	$95,958
Hemlock—	
Pounds	18,833,450
Value	$406,619
Oak and chestnut—	
Pounds	156,520,123
Value	$2,411,184
Palmetto—	
Pounds	1,740,000
Value	$34,800
Chrome tannage solution—	
Pounds	2,847,400
Value	$85,422
Other tanning liquors—	
Pounds	41,571,529
Value	$1,618,821
Tannic acid—	
Pounds	5,165,500
Value	$200,136
Sizes—	
Pounds	7,812,433
Value	$217,859
Gums and dextrin—	
Pounds	6,651,731
Value	$231,708
All other products, value	$1,455,563
Products consumed:	
Ground wood, pounds	524,505,744
Ground bark, pounds	40,390,640
Ground leaves, pounds	3,586,171
Ground roots, pounds	1,141,513
All other products consumed, pounds	1,728,797

TABLE 161.—SULPHURIC, NITRIC, AND MIXED ACIDS—DETAILED SUMMARY, MATERIALS AND PRODUCTS: 1905.

	United States.
Materials used, total cost	$4,972,838
Pyrites—	
Tons	197,847
Cost	$967,207
Sulphur—	
Tons	23,044
Cost	$479,529
Nitrate of soda—	
Tons	27,406
Cost	$1,143,280
Sulphuric acid—	
Tons	98,252
Cost	$992,549
Nitric acid—	
Pounds	1,960,000
Cost	$98,000
All other components of products, cost	$540,266
Fuel	$366,129
Rent of power and heat	$5,549
Mill supplies	$23,051
All other materials	$356,110
Freight	1,168
Products, total value	$9,052,646
Sulphuric, nitric, and mixed acids, total value	$6,955,078
Oleum—	
Tons	13,268
Value	$361,018
Sulphuric acid, 66° Baumé—	
Tons	199,663
Value	$2,886,179

	United States.
Products—Continued.	
Sulphuric, nitric, and mixed acids—Continued.	
Sulphuric acid, 60° Baumé—	
Tons	13,634
Value	$121,432
Sulphuric acid, 50° Baumé—	
Tons	128,389
Value	$917,683
Nitric acid—	
Pounds	30,306,555
Value	$1,446,471
Mixed acid—	
Pounds	42,812,894
Value	$1,222,295
Pyrite cinder—	
Tons	93,146
Value	$97,089
Niter cake—	
Tons	24,845
Value	$33,264
All other products, value	$1,967,215
Products consumed:	
Sulphuric acid, 66° Baumé, tons	51,083
Sulphuric acid, 60° Baumé, tons	14,703
Sulphuric acid, 50° Baumé, tons	6,601
Nitric acid, pounds	18,875,989
All other products consumed, tons	984,560

TABLE 162.—WOOD DISTILLATION—DETAILED SUMMARY, MATERIALS AND PRODUCTS: 1905.

	United States.
Materials used, total cost	$4,847,770
Wood—	
Cords	586,144
Cost	$1,783,004
Lime—	
Bushels	523,334
Cost	$101,068
Soda—	
Pounds	371,780
Cost	$5,484
Crude wood alcohol—	
Gallons	5,723,011
Cost	$1,976,156
Smoke, cost	$22,988
Fuel	$578,251
Rent of power and heat	$850
Mill supplies	$23,480
All other materials	$305,205
Freight	$51,284
Products, total value	$7,813,483
Wood alcohol, total value	$4,775,699
Crude wood alcohol—	
Gallons	6,684,871
Value	$2,161,813
Products—Continued.	
Wood alcohol—Continued.	
Refined wood alcohol—	
Gallons	4,316,346
Value	$2,613,886
Acetate of lime—	
Pounds	105,141,361
Value	$1,474,982
Charcoal—	
Bushels	23,872,055
Value	$1,197,973
Turpentine—	
Gallons	442,185
Value	$176,521
All other wood distillation products, value	$138,481
All other products, value	$49,827
Products consumed:	
Crude wood alcohol, gallons	[1] 620,391
Charcoal, bushels	11,026,978

[1] Includes 54,800 gallons of pyroligneous acid consumed in Massachusetts.

TABLE 163.—OIL, ESSENTIAL—DETAILED SUMMARY, MATERIALS AND PRODUCTS: 1905.

	United States.
Materials used, total cost	$1,110,470
Principal materials, total cost	$1,068,176
Purchased in raw state—	
Tons	53,201
Cost	$307,351
Purchased in partially manufactured form—	
Pounds	1,693,570
Cost	$760,825
Fuel	$10,159
Rent of power and heat	$3,592
Mill supplies	$1,965
All other materials	$22,245
Freight	$4,333
Products, total value	$1,464,662
Natural essential oils, total value	$1,391,810
Peppermint—	
Pounds	130,022
Value	$470,037
Products—Continued.	
Natural essential oils—Continued.	
Sassafras—	
Pounds	30,235
Value	$17,673
Wintergreen—	
Pounds	4,737
Value	$15,579
Other natural oils—	
Pounds	297,673
Value	$520,648
Witch hazel—	
Gallons	797,700
Value	$367,873
All other products, value	$72,852

COKE

COKE.

By Charles E. Munroe, Professor of Chemistry, George Washington University, Expert Special Agent.

As in previous censuses this report is limited to "oven coke," which is obtained from the dry distillation or imperfect combustion of bituminous coal in retorts, ovens, or pits. Ordinary gas-house coke, obtained as a by-product in the regular manufacture of illuminating gas, is not considered here, the statistics for its production being given under "manufactured gas." The statistics for petroleum coke are given under "petroleum refining." Although coke was manufactured in this country for some years prior to 1850, it was not included among manufactures until the census of that year. Separate returns have been received for this industry in each succeeding census, but as an analysis of the results recorded prior to 1880 seems to indicate that a considerable part of the product was lost in some other category, in this report the comparison of the results for different censuses begins with the census of 1880. That census covered the year ending May 31, 1880. The returns in each succeeding census were for the calendar year, excepting those for Michigan, in the census of 1905, which were for the year ending June 30, 1904.

The statistics are summarized in Table 1.

Table 1.—COMPARATIVE SUMMARY, AMOUNT AND PER CENT OF INCREASE: 1880 TO 1905.[1]

	CENSUS.				INCREASE.			PER CENT OF INCREASE.				
	1905	1900	1890	1880	1900 to 1905	1890 to 1905	1880 to 1905	1900 to 1905	1890 to 1905	1880 to 1905	1890 to 1900	1880 to 1890
Number of establishments	278	[2]241	218	126	37	60	152	15.4	27.5	120.6	10.6	73.0
Capital	$90,712,877	$36,502,679	$17,462,729	$4,769,858	$54,210,198	$73,250,148	$85,943,019	148.5	419.5	1,801.8	109.0	266.1
Salaried officials, clerks, etc., number	1,386	915	161	....	471	1,225	....	51.5	760.9	....	468.3	....
Salaries	$1,247,502	$797,296	$113,632	....	$450,206	$1,133,870	....	56.5	997.8	....	601.6	....
Wage-earners, average number	18,981	16,999	8,998	3,140	1,982	9,983	15,841	11.7	110.9	504.5	88.9	186.6
Total wages	$9,304,498	$7,085,736	$4,072,632	$1,197,744	$2,218,762	$5,231,866	$8,106,754	31.3	128.5	676.8	74.0	240.0
Men 16 years and over	18,915	16,932	8,942	....	1,983	9,973	....	11.7	111.5	....	89.4	....
Wages	$9,290,216	$7,071,834	$4,064,118	....	$2,218,382	$5,226,098	....	31.4	128.6	....	74.0	....
Children under 16 years	66	67	56	....	[3]1	10	....	[3]1.5	17.9	....	19.6	....
Wages	$14,282	$13,902	$8,514	....	$380	$5,768	....	2.7	67.7	....	63.3	....
Miscellaneous expenses	$4,891,130	$2,184,968	$394,784	(4)	$2,706,162	$4,496,346	....	123.9	1,138.9	....	453.5	....
Materials used, total cost	$29,884,532	$19,665,532	$11,509,737	$2,995,441	$10,219,000	$18,374,795	$26,889,091	52.0	159.6	897.7	70.9	284.2
Coal:												
Short tons	36,781,006	30,157,829	15,795,087	4,360,110	6,623,177	20,985,919	32,420,896	22.0	132.9	743.6	90.9	262.3
Cost	$28,360,121	$18,355,252	$11,110,700	$2,761,657	$10,004,869	$17,249,421	$25,598,464	54.5	155.3	926.9	65.2	302.3
All other materials	$1,524,411	$1,310,280	$399,037	$233,784	$214,131	$1,125,374	$1,290,627	16.3	282.0	552.1	228.3	70.7
Products, total value	$51,728,647	$35,585,445	$16,498,345	$5,359,489	$16,143,202	$35,230,302	$46,369,158	45.4	213.5	865.2	115.7	207.8
Coke:												
Short tons	24,733,063	19,640,798	10,008,169	2,752,475	5,092,265	14,724,894	21,980,588	25.9	147.1	798.6	96.2	263.6
Value	$49,002,051	$34,633,418	$16,494,454	$5,359,489	$14,368,633	$32,507,597	$43,642,562	41.5	197.1	814.3	110.0	207.8
All other products	$2,726,596	$952,027	$3,891	....	$1,774,569	$2,722,705	....	186.4	69,974.4	....	24,367.4	....

[1] Exclusive of the statistics of establishments making coke, but engaged primarily in the manufacture of other products; in 1905 the 17 establishments of this class produced 410,225 short tons of coke valued at $1 302,572.
[2] Not including 1 penal institution.
[3] Decrease.
[4] Not reported.

Table 1 embraces the principal statistics of the coke manufacturing industry at the censuses from 1880 to 1905, inclusive, and sets forth the percentage of increase in each item for each of the three periods treated. This table gives only the statistics of active establishments engaged primarily in the manufacture of coke. By capital is meant only that which is represented by the value of lands, buildings, ovens, machinery, tools, and implements, and the quick capital required to carry on the business. The term, as here used, does not include the capital stock of any of the corporations.

Table 2 presents, by states and territories, the number of coke establishments, including establishments engaged primarily in the manufacture of other products, in active operation in 1880, 1890, 1900, and 1905.

TABLE 2.—*Number of active establishments, by states and territories: 1880 to 1905.*

STATE OR TERRITORY.	1905	1900	1890	1880
United States	[1] 295	[2] 241	218	126
Alabama	24	15	19	3
Colorado	13	9	7	1
Georgia	2	2	1	1
Illinois	1	1	2	1
Indian Territory	4	2	1	....
Indiana	....	1	3	1
Kansas	4	8	6	....
Kentucky	7	5	5	....
Maryland	1	....	....	....
Massachusetts	1	1	....	....
Michigan	1	....	....	....
Minnesota	1	....	....	....
Missouri	....	3	3	....
Montana	2	2	2	....
New Jersey	1	....	....	....
New Mexico	2	2	....	....
New York	3	1	....	....
Ohio	6	5	13	15
Pennsylvania	112	89	98	89
Tennessee	9	8	8	4
Utah	2	1	1	....
Virginia	13	5	2	....
Washington	3	2	1	....
West Virginia	80	77	45	11
Wisconsin	2	1	1	....
Wyoming	1	1	....	....

[1] Includes 17 establishments engaged primarily in the manufacture of products other than coke.
[2] Not including 1 penal institution.

The Bureau of the Census classifies each establishment according to that one of its products which has the maximum value, and includes its other products in the classification. In order to obtain a complete idea of the magnitude and character of a given industry, such as the one now under consideration, it is necessary, therefore, that all the data relating to it should be brought together from all classifications. Additional establishments which produce coke have been included in Table 2 and the combined statistics have been incorporated in some minor tables. The number of these plants producing coke as a minor product at the census of 1905 was 17, of which 4 operated by-product ovens and 13 operated beehive ovens. They produced 410,225 tons of coke, valued at $1,302,572; by-products, valued at $423,385; and "all other products," valued at $504.

The number of coke producing states and territories has steadily increased from 9 states in 1880 to 17 states and 1 territory in 1890, 20 states and 2 territories in 1900, and 22 states and 2 territories in 1905. Comparing the states and territories reporting active establishments in 1905 with states and territories reporting a production of bituminous coal in 1902,[1] it is found that coke was produced in 5 states which do not produce bituminous coal, and that 11 states and territories producing bituminous coal did not report the production of coke. Four states, namely, Maryland, Michigan, Minnesota, and New Jersey, have been added to the list of coke producing states since 1900. Twelve states and 1 territory show an increase in the number of establishments. Kansas shows a decrease in the number of establishments, while Indiana and Missouri, which had, respectively, 1 and 3 active establishments in 1900, show no production in 1905. In Illinois and Indiana the production was less in 1900 than in 1890; but in Alabama, Pennsylvania, and Ohio, while the number of establishments was smaller in 1900 than in 1890, the production increased, showing the effect of consolidation and the abandonment of ovens operated on a small scale.

Table 3 gives a comparative summary of the ovens and capital of both active and idle establishments, with amount and per cent of increase, for 1890, 1900, and 1905, only those establishments engaged primarily in the production of coke being considered. No special effort was made in the present census to secure returns from idle establishments, and the statistics for such establishments should not, therefore, be regarded as complete.

[1] Bureau of the Census, Mines and Quarries, 1902, page 680.

TABLE 3.—CAPITAL—ACTIVE AND IDLE ESTABLISHMENTS: 1890 TO 1905.

	CENSUS.						ACTIVE ESTABLISHMENTS.				
	1905		1900		1890		Increase.		Per cent of increase.		
	Active.	Idle.	Active.	Idle.	Active.	Idle.	1900 to 1905	1890 to 1905	1900 to 1905	1890 to 1905	1890 to 1900
Number of establishments	278	29	[1] 241	14	218	28	37	60	15.4	27.5	10.6
Ovens, number	[2] 61,611	3,672	47,142	669	32,659	1,247	14,469	28,952	30.7	88.6	44.3
Capital	$90,712,877	$2,703,149	$36,502,679	$511,669	$17,462,729	$444,483	$54,210,198	$73,250,148	148.5	419.5	109.0
Land	$8,374,672	$577,965	$2,927,354	$13,950	$1,405,342	$6,425	$5,447,318	$6,969,330	186.1	495.9	108.3
Buildings	$14,235,683	$136,818	$2,382,237	$62,800	$869,725	$48,723	$11,853,446	$13,365,958	497.6	1,536.8	173.9
Ovens	$50,862,467	$875,377	$18,351,924	$303,469	$10,817,624	$312,661	$32,510,543	$40,044,843	177.2	370.2	69.6
Machinery, tools, and implements	$8,703,863	$421,755	$5,927,702	$131,450	$823,790	$44,791	$2,776,161	$7,880,073	46.8	956.6	619.6
Cash and sundries	$8,536,192	$691,234	$6,913,462	....	$3,546,248	$31,883	$1,622,730	$4,989,944	23.5	140.7	95.0

[1] Not including 1 penal institution.
[2] Does not include 17 establishments, operating 1,362 ovens, engaged primarily in the manufacture of products other than coke.

From the returns it appears that the total number of establishments, both active and idle, engaged primarily in the production of coke in 1905 was 307; in 1900, 255; and in 1890, 246. The number in 1905, therefore, showed a gain of 52, or 20.4 per cent, over 1900, and of 61, or 24.8 per cent, over 1890. The total number of ovens in these establishments in 1905 was 65,283; in 1900, 47,811; and in 1890, 33,906. Ovens, therefore, increased in number in 1905, 17,472, or 36.5 per cent, over 1900, and 31,377, or 92.5 per cent, over 1890.

The percentage of idle ovens to total ovens was 5.6 in 1905, 1.4 in 1900, and 3.7 in 1890.

The total capital was $93,416,026 in 1905, $37,014,348 in 1900, and $17,907,212 in 1890. The amount of capital invested in 1905 increased $56,401,678, or 152.4 per cent, over 1900, and $75,508,814, or 421.7 per cent, over 1890. The capital invested in idle plants represented 2.9 per cent of the total capital in 1905, 1.4 per cent in 1900, and 2.5 per cent in 1890. In 1905 the percentage of the total capital invested in land was 9.6; in buildings, 15.4; in ovens, 55.4; in machinery, tools, and implements, 9.7; and in cash and sundries, 9.9. In 1900 the percentage of total capital invested in land was 7.9; in buildings, 6.6; in ovens, 50.4; in machinery, tools, and implements, 16.4; and in cash and sundries, 18.7. In 1890 the percentage of total capital invested in land was 7.9; in buildings, 5.1; in ovens, 62.2; in machinery, tools, and implements, 4.8; and in cash and sundries, 20.

Table 4 shows the amount and cost of the coal charged into the ovens in 1880, 1890, 1900, and 1905, respectively, by states and territories, with the percentage of increase or decrease in quantity and in cost for each intervening decade.

TABLE 4.—QUANTITY AND VALUE OF COAL USED, WITH PER CENT OF INCREASE, BY STATES AND TERRITORIES: 1880 TO 1905.

STATE OR TERRITORY.	COAL CONSUMED.								PER CENT OF INCREASE.					
	1905		1900		1890		1880		1900 to 1905		1890 to 1900		1880 to 1890	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
United States	[1] 37,376,251	[1] $29,559,104	30,157,829	$18,355,252	15,795,087	$11,110,700	4,360,110	$2,761,657	23.9	61.0	90.9	65.2	262.3	302.3
Alabama	4,027,656	3,799,827	3,028,472	2,596,718	1,789,047	1,755,876	67,376	75,314	33.0	46.3	69.3	47.9	2,555.3	2,231.4
Colorado	1,000,206	922,394	817,725	496,033	323,731	399,778	29,500	29,500	22.3	85.9	152.6	24.1	997.4	1,255.2
Indian Territory	126,627	130,049												
Indiana					16,428	16,156	1,500	2,025					995.2	697.8
Kansas	14,107	20,084	26,988	26,079	21,600	9,011			[2] 47.7	[2] 23.0	24.9	189.4		
Kentucky	127,511	56,923	151,503	72,196	25,192	13,542			[2] 15.8	[2] 21.2	501.4	433.1		
Missouri			5,320	2,256	8,485	3,118					[2] 37.3	[2] 27.6		
Ohio	203,032	342,574	142,678	102,540	134,178	123,992	193,848	228,432	42.3	234.1	6.3	[2] 17.3	[2] 30.8	[2] 45.7
Pennsylvania	23,128,917	14,524,648	19,490,030	10,899,832	11,336,985	6,992,573	3,608,095	2,031,305	18.7	33.3	71.9	55.9	214.2	244.2
Tennessee	573,629	582,461	684,821	501,927	619,016	523,400	179,311	124,137	[2] 16.2	16.0	10.6	[2] 4.1	245.2	321.6
Virginia	1,676,256	1,105,432	994,635	523,979					68.5	110.0				
West Virginia	3,746,602	2,676,652	3,792,825	1,874,960	1,025,885	686,570	148,480	135,944	[2] 1.2	42.8	269.7	173.1	590.9	405.0
All other states	[3] 2,751,708	5,398,060	[4] 1,022,832	1,258,732	[5] 494,540	586,684	[6] 132,000	135,000	169.0	328.8	106.8	114.6	274.7	334.6

[1] Includes 595,245 short tons, valued at $1,198,983, used for the manufacture of coke in establishments engaged primarily in the manufacture of other products.
[2] Decrease.
[3] Includes Georgia, Illinois, Maryland, Massachusetts, Michigan, Minnesota, Montana, New Jersey, New Mexico, New York, Utah, Washington, Wisconsin, and Wyoming.
[4] Includes Georgia, Illinois, Indian Territory, Indiana, Massachusetts, Montana, New Mexico, New York, Utah, Washington, Wisconsin, and Wyoming.
[5] Includes Georgia, Illinois, Indian Territory, Montana, Utah, Virginia, Washington, and Wisconsin.
[6] Includes Georgia and Illinois.

Bituminous coal is the only raw material used in this industry and its cost, as charged into the ovens, is the principal item of expense. For Census purposes the cost of the coal consumed, whether mined in the immediate vicinity or transported from a distance, is its cost at the ovens, and all expenses of mining or of preparing the coal, such as crushing or washing, and of transportation to the ovens, is included in this cost. In the Census Report on Coke for 1900, after noting that the amount of coal used had increased 90.9 per cent, while its cost had increased only 65.2 per cent for the decade 1890 to 1900, it was stated: "This difference has been due in great part to improvements in mining machinery and methods, and in underground haulage, which have decreased the cost of production."[1] Judging from Table 4, such improvements have made no marked advance during the past five years. It further appears that the average cost per ton of coal consumed in making coke in the United States in 1905 was $0.79; in 1900, $0.61; in 1890, $0.70; and in 1880, $0.63. The average cost of coal consumed in making coke in the various states and territories in 1905 was Alabama, $0.94; Colorado, $0.92; Indian Territory, $1.03; Kansas, $1.42; Kentucky, $0.45; Ohio, $1.69; Pennsylvania, $0.63; Tennessee, $1.02; Virginia, $0.66; West Virginia, $0.71; and in "all other states," $1.96.

Table 5 presents a statement of the condition of the coal when charged into the coking ovens—that is, whether it was run of mine, or slack, and whether it was washed or unwashed; but it does not set forth any information as to the crushing of the coal, a practice which obtains in certain establishments before coking.

[1] Twelfth Census, Manufactures, Part IV, page 694.

TABLE 5.—QUANTITY AND COST OF DIFFERENT CLASSES OF COAL USED, WITH PER CENT OF INCREASE AND AVERAGE PRICE PER TON: 1890 TO 1905.

CLASS.	1905		1900		1890		PER CENT OF INCREASE.				AVERAGE PRICE PER SHORT TON.		
							1900 to 1905		1890 to 1900				
	Short tons.	Cost.	Short tons.	Cost.	Short tons.	Cost.	Quantity.	Cost.	Quantity.	Cost.	1905	1900	1890
Total	[1] 37,376,251	[1] $29,559,104	30,157,829	$18,355,252	15,795,087	$11,110,700	23.9	61.0	90.9	65.2	$0.79	$0.61	$0.70
Run of mine or lump, unwashed	25,165,692	17,663,115	20,844,637	12,309,681	11,631,436	8,255,542	20.7	43.5	79.2	49.1	0.70	0.59	0.71
Run of mine or lump, washed	2,902,721	3,885,787	1,457,961	1,304,437	421,074	305,983	99.1	197.9	246.2	326.3	1.34	0.89	0.73
Slack, unwashed	4,459,784	3,439,769	5,036,675	2,966,800	3,195,322	2,333,597	[2] 11.5	15.9	57.6	27.1	0.77	0.59	0.73
Slack, washed	4,848,054	4,570,433	2,818,556	1,774,334	547,255	215,578	72.0	157.6	415.0	723.1	0.94	0.63	0.39

[1] Includes 595,245 short tons, valued at $1,198,983, used in establishments engaged primarily in the manufacture of other products.
[2] Decrease.

From Table 5 it appears that of the coal used in the coke industry, the run of mine constituted 75.1 per cent in 1905, 74 per cent in 1900, and 76.3 per cent in 1890. Of this run of mine coal, the per cent washed was 10.3 in 1905, 6.5 in 1900, and 3.5 in 1890; while of the slack coal, the per cent washed was 52.1 in 1905, 35.9 in 1900, and 14.6 in 1890. In 1905 the total quantity of coal reported as washed was 7,750,775 short tons, in 1900 it was 4,276,517 short tons, and in 1890 it was 968,329 short tons. This was an increase of 81.2 per cent for 1905 over 1900 and 700.4 per cent over 1890. To present the data in another form, it may be said that of the total coal used, that washed formed 20.7 per cent in 1905, 14.2 per cent in 1900, and only 6.1 per cent in 1890.

Table 6 presents a statement of the amount and value of coke produced in the census years 1880 to 1905, inclusive; the amount and cost of coal used; the amount of coal, in pounds, necessary to produce a short ton of coke; and the value of the coal used to a ton of the coke produced.

TABLE 6.—*Comparative summary—relation of coal used to coke produced: 1880 to 1905.*

	1905	1900	1890	1880
Coal used:				
Short tons	[1] 37,376,251	30,157,829	15,795,087	4,360,110
Cost	$29,559,104	$18,355,252	$11,110,700	$2,761,657
Average cost per short ton	$0.79	$0.61	$0.70	$0.63
Coke made:				
Short tons	[2] 25,143,288	19,640,798	10,008,169	2,752,475
Value	$50,304,623	$34,633,418	$16,494,454	$5,359,489
Average value per short ton	$2.00	$1.76	$1.65	$1.95
Coal used per short ton of coke (pounds)	2,973	3,070	3,156	3,168
Average cost of coal to short ton of coke	$1.18	$0.93	$1.11	$1.00

[1] Includes 595,245 short tons, valued at $1,198,983, used in establishments engaged primarily in the manufacture of other products.
[2] Includes 410,225 short tons, valued at $1,302,572, made in establishments engaged primarily in the manufacture of other products.

The output of coke in 1905 was greater by 5,502,490 tons, or 28 per cent, than in 1900; by 15,135,119 tons, or 151.2 per cent, than in 1890; and by 22,390,813 tons, or 813.5 per cent, than in 1880. The value of the coke increased $15,671,205, or 45.2 per cent, in 1905 over 1900; $33,810,169, or 205 per cent, over 1890; and $44,945,134, or 838.6 per cent, over 1880. The average value per ton for coke in 1905 increased $0.24, or 13.6 per cent, over the value in 1900; $0.35, or 21.2 per cent, over that in 1890; and $0.05, or 2.6 per cent, over that in 1880. The amount of coal used in 1905 was 37,376,251 tons, yielding 25,143,288 tons of coke, which indicates a loss in weight caused by the coking process of 32.7 per cent. The value of the coal used was $29,559,104, and the value of the coke produced was $50,304,623, an increase of 70.2 per cent due to the process. In 1900 the coking process caused a decrease of 34.9 per cent in the weight of the coal and an increase of 88.7 per cent in its value, while in 1890 the corresponding figures were 36.6 per cent decrease in weight and 48.5 per cent increase in value, and in 1880 they were 36.9 and 94.1 per cent, respectively. The amount of coal necessary to make a hundred tons of coke was 148.7 tons in 1905, 153.5 tons in 1900, 157.8 tons in 1890, and 158.4 tons in 1880. The amount of coal necessary to produce a ton of coke continues to grow less, showing a continued increase in the efficiency of the coking operations.

Table 7 shows, by states and territories, the total amount of coal used and of coke produced in 1890, 1900, and 1905, together with the percentage of coal in coke in each state and territory at each of these censuses. By the yield of coal in coke is meant the percentage of the original weight of the coal that remains in the form of coke after the process of coking is complete.

TABLE 7.—QUANTITY AND PER CENT OF YIELD OF COAL IN COKE, BY STATES AND TERRITORIES: 1890 TO 1905.

STATE OR TERRITORY.	1905			1900			1890		
	Short tons of coal used.	Short tons of coke manufactured.	Per cent of yield in coke.	Short tons of coal used.	Short tons of coke manufactured.	Per cent of yield in coke.	Short tons of coal used.	Short tons of coke manufactured.	Per cent of yield in coke.
United States	[1]37,376,251	[1]25,143,288	67.3	30,157,829	19,640,798	65.1	15,795,087	10,008,169	63.4
Alabama	4,027,656	2,335,613	58.0	3,028,472	1,787,809	59.0	1,789,047	1,055,823	59.0
Colorado	1,000,206	585,662	58.6	817,725	503,543	61.6	323,731	199,638	61.7
Indian Territory	126,627	54,761	43.2	....	....	....	....	....	....
Indiana	....	....	....	....	....	....	16,428	8,301	50.5
Kansas	14,107	9,091	64.4	26,988	14,476	53.6	21,600	13,910	64.4
Kentucky	127,511	63,092	49.5	151,503	81,095	53.5	25,192	13,021	51.7
Missouri	....	....	....	5,320	2,860	53.8	8,485	5,275	62.2
Ohio	203,032	120,631	59.4	142,678	83,878	58.8	134,178	75,826	56.5
Pennsylvania	23,128,917	16,308,934	70.5	19,490,030	13,245,594	68.0	11,336,985	7,372,653	65.0
Tennessee	573,629	324,451	56.6	684,821	380,525	55.6	619,016	356,964	57.7
Virginia	1,676,256	1,139,010	67.9	994,635	618,707	62.2	....	....	....
West Virginia	3,746,602	2,355,146	62.9	3,792,825	2,278,679	60.1	1,025,885	612,645	59.7
All other states	[2]2,751,708	1,846,897	67.1	[3]1,022,832	643,632	62.9	[4]494,540	294,113	59.5

[1] Includes 595,245 short tons of coal used and 410,225 short tons of coke made in establishments engaged primarily in the manufacture of other products.
[2] Includes Georgia, Illinois, Maryland, Massachusetts, Michigan, Minnesota, Montana, New Jersey, New Mexico, New York, Utah, Washington, Wisconsin, and Wyoming.
[3] Includes Georgia, Illinois, Indian Territory, Indiana, Massachusetts, Montana, New Mexico, New York, Utah, Washington, Wisconsin, and Wyoming.
[4] Includes Georgia, Illinois, Indian Territory, Montana, Utah, Virginia, Washington, and Wisconsin.

The table shows that the yield of coal in coke in 1905 was 67.3 per cent as compared with 65.1 per cent in 1900 and 63.4 per cent in 1890. This increase in yield is accounted for partly by the introduction and increased use of by-product ovens, partly by improvements in the construction and operation of the beehive ovens, and partly by the preparation of the coal itself through washing or other treatment, prior to its being charged into the ovens. In 1905, of the 25,143,288 short tons of coke produced, 2,422,796 short tons, or 9.6 per cent, were produced in by-product ovens, while in 1900, of the 19,640,798 short tons produced, 906,534 short tons, or 4.6 per cent, were produced in by-product ovens. As stated above, no by-product coke was reported prior to 1900. The extent to which washing is practiced may be ascertained by an inspection of Table 5. From the analysis of the data in this table and Table 4, it appears that while the increase in the coal used in coking in 1905 is but 136.6 per cent over that for 1890, the increase in quantity of coal that was washed for use in coking in 1905 was 700.4 per cent over that of 1890.

The highest yield of coal in coke in each of the three census years was reported for Pennsylvania. The lowest yield in 1905 was in Indian Territory, 43.2 per cent; in 1900 it was in Kentucky, 53.5 per cent; and in 1890 it was in Indiana, 50.5 per cent. It must be stated in this connection, and the same statement should be made in regard to the amount of coal used in the manufacture of coke, that it is not possible to secure absolutely accurate information in regard to the yield of coal in coke for the reason that, in many instances, the coal is not weighed before being charged into the ovens, and therefore the amount as reported in the schedules is frequently estimated. The figures, however, may be taken as fairly representing the conditions.

For each state and territory in which there are at least 3 establishments, Table 8 gives for 1880, 1890, 1900, and 1905 the quantity of coke produced, the rank according to production, and the percentage which each makes of the total output for the United States. The statistics for the states and territories in each of which there are less than 3 establishments are combined in groups.

TABLE 8.—PRODUCTION OF COKE, BY STATES AND TERRITORIES, WITH RANK OF EACH: 1880 TO 1905.

STATE OR TERRITORY.	SHORT TONS OF COKE.				PER CENT OF TOTAL OUTPUT.				RANK.			
	1905	1900	1890	1880	1905	1900	1890	1880	1905 [1]	1900	1890	1880
United States	[2] 25,143,288	19,640,798	10,008,169	2,752,475	100.0	100.0	100.0	100.0	...	...	...	...
Pennsylvania	16,308,934	13,245,594	7,372,653	2,317,149	64.9	67.4	73.7	84.2	1	1	1	1
West Virginia	2,355,146	2,278,679	612,645	95,720	9.4	11.6	6.1	3.5	2	2	3	3
Alabama	2,335,613	1,787,809	1,055,823	42,035	9.3	9.1	10.5	1.5	3	3	2	6
Virginia	1,139,010	618,707	[3]	...	4.5	3.2	[3]	...	4	4	6	...
Colorado	585,662	503,543	199,638	18,000	2.3	2.6	2.0	0.7	5	5	5	7
Tennessee	324,451	380,525	356,964	91,675	1.3	1.9	3.6	3.3	8	6	4	4
Ohio	120,031	83,878	75,826	109,296	0.5	0.4	0.8	4.0	14	8	8	2
Kentucky	63,092	81,095	13,021	...	0.3	0.4	0.1	...	16	9	12	...
Indian Territory	54,761	24,339	[3]	...	0.2	0.1	[3]	...	17	17	15	...
Kansas	9,091	14,476	13,910	...	[4]	0.1	0.1	...	22	19	11	...
Missouri	...	2,860	5,275	...	...	[4]	0.1	...	...	20	16	...
Indiana	...	2,105	8,301	1,000	...	[4]	0.1	[4]	...	21	14	9
Massachusetts	1,034,727	[3]	...	...	4.1	[3]	...	...	6	7	...	...
New York		[3]	...	...		[3]	...	...	10	15	...	...
New Jersey		...	...	...		...	...	...	15	...	...	...
Maryland		...	...	...		...	...	...	7	...	...	...
Georgia	489,465	[3]	[3]	[3]	1.9	[3]	[3]	[3]	13	11	7	5
Illinois		[3]	[3]	[3]		[3]	[3]	[3]	23	22	13	8
Minnesota		...	...	...		...	...	...	21	...	...	...
Wisconsin		[3]	[3]	...		[3]	[3]	...	11	13	9	...
Michigan		...	...	...		...	...	...	12	...	...	...
Montana	322,705	[3]	[3]	...	1.3	[3]	[3]	...	20	10	10	...
New Mexico		[3]	...	...		[3]	...	...	18	12	...	...
Utah		[3]	[3]	...		[3]	[3]	...	9	16	18	...
Washington		[3]	[3]	...		[3]	[3]	...	19	14	17	...
Wyoming		[3]	...	...		[3]	...	...	24	18	...	...
All other states	...	[5] 617,188	[6] 294,113	[7] 77,600	...	[5] 3.2	[6] 2.9	[7] 2.8	...	...	...	...

[1] Includes 17 subsidiary establishments.
[2] Includes 410,225 short tons made in establishments engaged primarily in the manufacture of other products.
[3] Included in "all other states."
[4] Less than one-tenth of 1 per cent.
[5] Includes Georgia, Illinois, Massachusetts, Montana, New Mexico, New York, Utah, Washington, Wisconsin, and Wyoming.
[6] Includes Georgia, Illinois, Indian Territory, Montana, Utah, Virginia, Washington, and Wisconsin.
[7] Includes Georgia and Illinois.

As in the past, the coke production of Pennsylvania in 1905 greatly exceeded that of any other state, but the margin is steadily decreasing, for whereas in 1880 the product of Pennsylvania constituted 84.2 per cent of the total, in 1890 it was 73.7 per cent, in 1900, 67.4 per cent, and in 1905 but 64.9 per cent. As in 1900, of the 6 leading coke producing states, 5, namely, Pennsylvania, West Virginia, Alabama, Virginia, and Tennessee, drew their coal supply from the coal fields of the Appalachian system, but whereas the proportion of the product coming from this field constituted in 1890, 92.5 per cent of the total and in 1900, 93.2 per cent, in 1905 it was but 89.4 per cent. In 1905 the coke producing states and territories west of the Mississippi, including Minnesota, yielded 4 per cent of the total output, and 6 states—Massachusetts, New York, New Jersey, Maryland, Minnesota, and Wisconsin—operating ovens at a distance from the coal fields, produced 4.9 per cent of the total. Massachusetts imported coal from abroad, but the major part of the supply for the other 5 states was drawn from the Appalachian fields. In 1905 the number of states each of which produced more than 100,000 tons of coke in the census year was 15, as compared with 7 in 1900, 5 in 1890, and 2 in 1880. Of the states which produced more than 100,000 tons each in 1905, 2—Colorado and Utah—are west of the Mississippi. In 1905 the total coke production was 28 per cent greater than in 1900, for there were 14 states each of which produced five-tenths of 1 per cent or more of the total production, while in 1900 there were but 6 states of which this was true. Considering the rank, Table 8 shows that there were 24 states and territories in which coke was produced in 1905, as compared with 22 in 1900, 18 in 1890, and 9 in 1880. At each census Pennsylvania has stood at the head of the coke producing states. West Virginia, Alabama, Virginia, and Colorado hold the second, third, fourth, and fifth places, respectively, in 1905, as they did at the census of 1900, while the first three occupied practically the same relative positions at the census of 1890. Massachusetts, which entered the list in 1900, taking the seventh place, passed to the sixth in 1905, while Maryland, which entered the list in 1905, took the seventh place. The most marked change in rank between the censuses of 1900 and 1905 is found in the case of Montana, which has passed from the tenth to the twentieth place. The most notable changes in rank between the censuses of 1880 and 1905 are to be observed in the cases of Indiana, which, though ninth in 1880, had ceased to produce in 1905; Illinois, which had dropped from the eighth to the twenty-third place; and Ohio, which had dropped from the second to the fourteenth place. It is of interest to note that Massachusetts, Maryland, New York, Wisconsin, and New Jersey, states in which by-product coke ovens are operated at

a distance from the bituminous coal deposits, took rank in the sixth, seventh, tenth, eleventh, and fifteenth places, respectively.

Table 9 gives a summary of the number of ovens in operation in 1880, 1890, 1900, and 1905, together with the amount of coal used, the amount and value of the coke produced, the average yield of coke in tons per oven, the average value per ton of coke at the ovens, and the percentage yield of the coal in coke.

TABLE 9.—OVENS OPERATED, QUANTITY AND VALUE OF COKE, AND YIELD OF COAL IN COKE: 1880 TO 1905.

	CENSUS.				PER CENT OF INCREASE.		
	1905	1900	1890	1880	1900 to 1905	1890 to 1900	1880 to 1890
Ovens, active, number	[1] 62,973	47,142	32,659	9,738	33.6	44.3	235.4
Coal used, short tons	[2] 37,376,251	30,157,829	15,795,087	4,360,110	23.9	90.9	262.3
Coke produced, short tons	[2] 25,143,288	19,640,798	10,008,169	2,752,475	28.0	96.2	263.6
Coke produced per oven, average yield, short tons	399	417	306	283	[3] 4.3	36.3	8.1
Yield of coal in coke, per cent	67.3	65.1	63.4	63.1			
Value of coke at ovens, total	[2] $50,304,623	$34,633,418	$16,494,454	$5,359,489	45.2	110.0	207.8
Per short ton	$2.00	$1.76	$1.65	$1.95	13.6	6.7	[3] 15.4

[1] Includes 1,362 ovens in 17 establishments engaged primarily in the manufacture of other products.
[2] Includes 595,245 short tons of coal and 410,225 short tons of coke, valued at $1,302,572, made in establishments engaged primarily in the manufacture of other products.
[3] Decrease.

Each item in Table 9, except the average yield of coke per oven, shows an increase for 1905 over the previous censuses. The decrease in the average yield of coke per oven is offset by the increase in the percentage yield of coal in coke. It should be noted that the total value of the coke and its average price per ton represent the value of the coke at the ovens before the expenses of transportation and marketing have been added.

Table 10 gives a comparative summary of the number and kinds of ovens in active operation, by states and territories, for 1890, 1900, and 1905.

TABLE 10.—*Comparative summary—number and kind of ovens in active use, by states and territories: 1890 to 1905.*

STATE OR TERRITORY.	Census.	OVENS.				
		Total number.	Beehive.	Belgian or flue.	By-product.	Other styles.
United States	1905	[1] 62,973	60,733	66	2,174	
	1900	47,142	45,680		1,020	442
	1890	32,659	32,129	233		297
Alabama	1905	5,247	5,007		240	
	1900	5,206	4,872		120	214
	1890	3,693	3,459	160		74
Colorado	1905	2,250	2,208	42		
	1900	1,221	1,185			36
	1890	872	672			200
Georgia	1905	451	451			
	1900	350	350			
	1890	(2)				
Illinois	1905	24		24		
	1900	4	4			
	1890	(2)				
Indian Territory	1905	286	286			
	1900	130	130			
	1890	(2)				
Indiana	1905					
	1900	12	12			
	1890	102	102			
Kansas	1905	18	18			
	1900	86	86			
	1890	52	52			

[1] Includes 1,362 ovens—1,070 beehive and 292 by-product—operated by establishments engaged primarily in manufacturing products other than coke.

TABLE 10.—*Comparative summary—number and kind of ovens in active use, by states and territories: 1890 to 1905*—Continued.

STATE OR TERRITORY.	Census.	OVENS.				
		Total number.	Beehive.	Belgian or flue.	By-product.	Other styles.
Kentucky	1905	265	265			
	1900	290	290			
	1890	164	164			
Maryland	1905	180			180	
	1900					
	1890					
Massachusetts	1905	359			359	
	1900	400			400	
	1890					
Michigan	1905	120			120	
	1900					
	1890					
Minnesota	1905	50			50	
	1900					
	1890					
Missouri	1905					
	1900	12	12			
	1890	9	9			
Montana	1905	315	315			
	1900	203	203			
	1890	(2)				
New Jersey	1905	100			100	
	1900					
	1890					
New Mexico	1905	284	284			
	1900	114	114			
	1890					
New York	1905	315			315	
	1900	25			25	
	1890					
Ohio	1905	331	251		80	
	1900	235	235			
	1890	462	462			
Pennsylvania	1905	37,205	36,675		530	
	1900	26,920	26,565		355	
	1890	21,405	21,338	48		19
Tennessee	1905	1,022	1,022			
	1900	1,727	1,727			
	1890	1,581	1,577			4
Utah	1905	504	504			
	1900	104	104			
	1890	(2)				

[2] Included in "all other states and territories."

Table 10.—*Comparative summary—number and kind of ovens in active use, by states and territories: 1890 to 1905*—Continued.

STATE OR TERRITORY.	Census.	OVENS. Total number.	Beehive.	Belgian or flue.	By-product.	Other styles.
Virginia	1905	3,426	3,426			
	1900	1,588	1,528		60	
	1890	(1)				
Washington	1905	139	139			
	1900	90	90			
	1890	(1)				
West Virginia	1905	9,910	9,790		120	
	1900	8,231	7,979		60	192
	1890	3,140	3,140			
Wisconsin	1905	152	72		80	
	1900	120	120			
	1890	(1)				
Wyoming	1905	20	20			
	1900	74	74			
	1890					
All other states and territories.	1905					
	1900					
	[2]1890	1,179	1,154	25		

[1] Included in "all other states and territories."
[2] Includes Georgia, Illinois, Indian Territory, Montana, Utah, Virginia, Washington, and Wisconsin. Each state producing coke is reported separately for 1900 and 1905.

In comparing the number of establishments reported at different censuses it should be borne in mind that the method of reporting them differs from time to time with the changes in business organization. Separate plants reported as individual establishments at one census may have come under the same ownership during the period between censuses and be reported as a single establishment at a subsequent census. Such changes in the method of enumeration affects all details based upon the establishment as a unit of measurement.

In the United States the average number of ovens to an establishment increased from 196 in 1900 to 213 in 1905. In the three states that produce most of the coke the average number was: Pennsylvania, 332 in 1905 and 302 in 1900; West Virginia, 124 in 1905 and 107 in 1900; Alabama, 219 in 1905 and 347 in 1900. By far the greater portion of the coke manufactured in the United States is still made in the ordinary beehive ovens, of which there were 60,733 out of a total of 62,973 active ovens reported for 1905; 45,680 out of a total of 47,142 active ovens reported for 1900; and 32,129 out of a total of 32,659 active ovens reported for 1890. No coke has been reported as being produced in pits or mounds since 1890. In late years this method was employed merely in testing the value of coal for the production of coke, but the test is now made in a more satisfactory manner by shipping the coal to a properly constructed oven. The Belgian or flue ovens, reported separately in 1890 and 1905, were in 1900 included among "other styles." No by-product ovens were reported until 1900, when 1,020 ovens of this type, yielding 906,534 tons of coke, were enumerated. In 1905 there were reported 2,174 by-product ovens, yielding 2,422,796 tons of coke.

Table 11 presents the statistics relating to the capital and to the kind and the number of ovens in idle establishments, by states and territories, for 1890, 1900, and 1905.

Table 11.—*Comparative summary—capital and ovens in idle establishments, by states and territories: 1890 to 1905.*

STATE OR TERRITORY.	Census.	Number of establishments reporting.	Capital.	OVENS. Total number.	Beehive.	Belgian or flue.	Other styles.
United States	1905	29	$2,703,149	3,672	3,647		25
	1900	14	511,669	669	665		4
	1890	28	444,483	1,247	1,142	65	40
Alabama	1905	6	239,196	1,555	1,555		
	1900	1	20,000	90	90		
	1890	1	19,000	76	76		
Colorado	1905	1	8,000	21	21		
	1900	3	17,900	22	18		4
	1890	3	12,600	48	8		40
Illinois	1905						
	1900	2	83,700	126	126		
	1890	1	50,000	102	102		
Indiana	1905						
	1900						
	1890	1	1,800	9	9		
Kansas	1905						
	1900						
	1890	1	5,136	16	16		
Kentucky	1905						
	1900	1	5,000	10	10		
	1890	1	600	2	2		
Montana	1905						
	1900	1	244,000	100	100		
	1890						
New Mexico	1905						
	1900	1	76,069	76	76		
	1890						
Ohio	1905						
	1900	1	5,800	9	9		
	1890						
Pennsylvania	1905	8	1,345,845	366	341		25
	1900	4	59,200	236	236		
	1890	15	317,297	884	819	65	
Tennessee	1905	2	71,705	245	245		
	1900						
	1890	2	16,050	58	58		
Washington	1905	1	50,000	25	25		
	1900						
	1890						
West Virginia	1905	11	988,403	1,460	1,460		
	1900						
	1890	3	22,000	52	52		

The capital invested in idle establishments has increased steadily in the three censuses for which the information has been gathered, it being $2,191,480, or 428.3 per cent, greater in 1905 than in 1900, and $2,258,666, or 508.2 per cent, greater in 1905 than in 1890. The percentage of capital invested in idle establishments of that invested in active establishments was 3 in 1905, 1.4 in 1900, and 2.5 in 1890. The total capital invested in idle establishments in 1905 was divided among the states as follows: Pennsylvania, 49.8 per cent; West Virginia, 36.6 per cent; Alabama, 8.8 per cent; Tennessee, 2.7 per cent; Washington, 1.8 per cent; and Colorado three-tenths of 1 per cent. While the capital invested in idle establishments has constantly increased, the number of idle ovens has fluctuated. In 1905 the number of idle establishments was 15, or 107.1 per cent, greater than in 1900,

and the number of idle ovens in 1905 was 3,003, or 448.9 per cent, greater than in 1900. Table 11 shows that the idle ovens were principally of the beehive type, and that the largest number of idle establishments and idle ovens were located in West Virginia, though the largest investment was in Pennsylvania. This was due to the fact that a portion of the ovens idle in Pennsylvania were of the by-product type.

BY-PRODUCTS.

Table 12 shows the quantity and value of the by-products obtained from retort or by-product ovens in 1900 and 1905, enumerating the more important of these.

TABLE 12.—*By-products: 1905 and 1900.*

	Unit of measure.	1905		1900	
		Number.	Value.	Number.	Value.
Total value			$3,147,288		$952,027
Tar	Gallons	26,223,323	613,388	10,468,733	207,952
Ammonium sulphate.	Pounds	31,546,781	818,290	11,984,931	330,921
Ammonia liquor	Gallons	4,791,468	763,291	1,572,325	180,642
Surplus gas sold	Thousand cubic feet.	4,463,062	843,787	1,171,943	225,022
Unclassified			108,532		7,490

The modern by-product oven, for the recovery on a commercial scale of the volatile bodies driven off from coal during the process of coking, was introduced in the United States in 1892, and the statistics of 1900 are therefore the first available for by-products. The by-products consist chiefly of tar; ammonia, obtained in the form of ammonium sulphate or as ammoniacal liquor; and surplus gas, which is sold for generating light, heat, and power.

The unclassified by-products consist of benzol, which is condensed and removed from that portion of the gas which is to be used as fuel in the ovens, pyridine, phenols, and other substances. The term "by-product" has a specific meaning in the coke industry. It is the general term by which those substances which were lost in the older processes of coking but which are recovered by the modern methods of coking are designated. Care should be taken that "by-products" should not be confused with "all other products," for this latter covers transactions in products like lumber, which are purely incidental to the carrying on of the coke industry. The value returned for these products in 1905 was $3,147,288, an increase over 1900 of $2,195,261, or 230.6 per cent. No attempt has been made in this investigation to ascertain the quantity and value of the products obtained from the coal tar, as in this industry tar is a final product. The quantity of gas produced was 20,695,371,300 cubic feet, of which 16,232,309,487 cubic feet were consumed in the process of carbonizing coal. No statistics are available from any previous census with which to compare this.

The total coal reported used in by-product ovens in 1905 was 3,317,585 tons. The number of cubic feet of gas produced per ton of coal used in by-product ovens was 6,238. In some instances, while the plants were under construction and before the by-product apparatus was available for use, the ovens were being operated to produce coke, and so gas and other volatiles were lost, and therefore the yield of gas per ton of coal as given above is lower than the possible yield. The total quantity of coal coked in 1905 was 37,376,251 tons, of which 3,317,585 tons, or 8.9 per cent, was coked in by-product ovens. The total quantity of coke produced in 1905 was 25,143,288 tons, of which 2,422,796 tons, or 9.6 per cent, was produced in by-product ovens. Of the 19,640,798 tons of coke produced in 1900, the by-product ovens made 906,534 tons, or 4.6 per cent. The coke produced in by-product ovens in 1905 was 1,516,262 tons, or 167.3 per cent, in excess of that produced in such ovens in 1900. The percentage yield of coal in coke in by-product ovens in 1905 was 73, while the yield of coal in coke for the total coal used in 1905 was 67.3.

The yield of tar per ton of coal used was 7.9 gallons, and its value $0.023 per gallon. The average yield of tar per ton of bituminous coal is usually accepted as 10 gallons. As tar is generally sold in barrels holding 50 gallons, the number of barrels reported was 524,466. The average weight of tar is 10 pounds per gallon, and the weight returned is therefore 262,233,000 pounds. These statistics for tar are subject to the same criticism that has been given above in regard to the data returned for gas.

The ammonia compounds obtained from the coal are reported in two forms. In the early practice of the destructive distillation of coal the ammonia compounds were recovered and disposed of as ammoniacal liquor, but to-day the practice at many of the by-product coke plants is to treat this liquor further so as to convert its ammonia contents into ammonium sulphate. It is desirable, in discussing the ammonium compounds produced, to reduce them to a common basis. Ammonium sulphate is to be preferred as a base for reference, as it is a definite substance of well-known composition, while the ammoniacal liquor is a variable mixture of many substances. In calling for the returns for "ammonia liquor," the "strength" was asked; and as returned it varied widely among the different establishments reporting. The data of each establishment were therefore reduced to terms of ammonium sulphate and the yield per ton of coal noted, and where the result varied from the limits fixed by Pennock,[1] they were inquired into specially. It was thus learned that the quantity of coal coked in by-product ovens from which the ammonia compounds were recovered was but 3,255,625 tons. The total

[1] V. Internationaler Kongress für angewandte Chemie, vol. 2, page 784.

quantity of ammonium compounds recovered, calculated as ammonium sulphate, was 62,633,417 pounds. This gives an average yield of 19.24 pounds of ammonium sulphate per ton of coal carbonized. Pennock gives the average as 20 pounds of ammonium sulphate per ton of coal. The average value of the ammonium sulphate reported was $0.026 per pound, and of the ammonia liquor, $0.159 per gallon.

It is possible from the statistics reported to calculate the quantity and value of the total products which might have been obtained if all of the coal which was coked in 1905 had been coked in by-product ovens, and such a presentation affords some idea of the loss which results from present practice.

Table 13 shows the quantity and value of all the products returned in 1905, with the percentage which the value of each product bears to the total value, the quantity of each product which would have been obtained if the entire 37,376,251 tons of coal had been coked in by-product ovens so that the volatiles were recovered, and the value of these products at the rate per unit which obtained in 1905.

TABLE 13.—ACTUAL QUANTITY AND VALUE OF ALL PRODUCTS REPORTED IN 1905, AND POSSIBLE QUANTITY AND VALUE OF PRODUCTS IF TOTAL COAL HAD BEEN TREATED IN BY-PRODUCT OVENS.

	Unit of measure.	ACTUAL.			POSSIBLE.	
		Quantity.	Value.	Per cent of total value.	Quantity.	Value.
Total			$53,455,108	100.0		$90,947,244
Coke	Short tons	[1] 25,143,288	[1] 50,304,623	94.1	27,295,467	54,610,526
Tar	Gallons	26,223,323	613,388	1.2	295,273,173	6,906,697
Ammonium sulphate	Pounds	31,546,781	818,290	1.5	719,119,069	18,697,096
Ammonia liquor	Gallons	4,791,468	763,291	1.4		
Gas for consumption in ovens	Thousand cubic feet	16,232,309			183,025,147	
Surplus gas for sale	do	4,463,062	843,787	1.6	50,127,907	9,474,174
Unclassified by-products			108,532	0.2		1,222,733
All other products			3,197	(2)		36,018

[1] Includes 410,225 short tons valued at $1,302,572 made in establishments engaged primarily in the manufacture of other products.
[2] Less than one-tenth of 1 per cent.

The average yield of gas per ton of coal reported for the by-product ovens was 6,238 cubic feet. At this same rate the 37,376,251 tons of coal would have yielded 233,153,053,738 cubic feet. The percentage of the total gas produced in by-product ovens in 1905 which was sold was 21.6, and the average price at which it was sold was $0.189 per thousand cubic feet. Had all of the coal used in 1905 been coked in by-product ovens, the volume of gas available for sale, assuming the same percentage as for 1905, would have been 50,127,906,554 cubic feet, and its value at $0.189 per thousand cubic feet would have been $9,474,174, or there would have been an increase of $8,630,387 over the actual return. Proceeding in a similar manner for the coke, and assuming the same percentage yield of coke in coal, the increase in the yield of coke would have been 2,152,179 tons, and, at the same rate per ton, the increase in value would have been $4,305,903. Treating the data for tar in the same manner, and assuming the same yield per ton and same value per gallon as for that reported, the increase in the yield of tar would have been 269,049,060 gallons, and the increase in the value $6,293,309. Considering the ammonia compounds and assuming them to be recovered as ammonium sulphate, the increase in quantity would have been 656,485,652 pounds, and the increase in value, $17,115,515. From a similar point of view, the increase in value of the unclassified by-products would have been $1,114,201. From a comparison of the total value of the actual products shown in Table 13 with the total value of the possible products, it appears that there would have been a gain of $37,492,136, or 70.1 per cent, in value if all the coal coked in 1905 had been treated in by-product ovens. This increase is based on the assumption that the value per unit which obtained in 1905 would be maintained for the entire output. Such, however, would not be the case, for the supply of some, at least, of the by-products would greatly exceed the existing demand, and the value would consequently fall. Nevertheless, there will be an ultimate economic gain in the treatment of the coal in by-product ovens, for, with the growth of and improvements in the arts, there will be a constant increase in the demand for the products not only to apply more extensively to present uses, but, as such, to put to new uses, while many of them will undoubtedly become sources of new commercial products.

FOREIGN TRADE IN COKE AND COKE BY-PRODUCTS.

This industry is affected by foreign competition, and it is desirable to consider here the condition of our foreign commerce in the commodities which are the products of the coke industry. The statistics for this have been compiled from "Commerce and Navigation of the United States," issued annually by the Bureau of Statistics, Department of Commerce and Labor. Table 14 presents the quantity and value of coke imported into and exported from the United States for each year from 1896 to 1905. The importations and exportations for 1905 are included, for while the census year is from January to December, 1904, inclusive, the

fiscal year of the Treasury is from July 1, 1904, to June 30, 1905, and this would largely cover the period in which the manufactures of the calendar year 1904 were disposed of.

TABLE 14.—*Imports and exports of coke: 1896 to 1905.*

YEAR.	IMPORTS.		EXPORTS.			
			Domestic.		Foreign.	
	Long tons.	Value.	Long tons.	Value.	Long tons.	Value.
1896	44,812	$117,361	130,070	$500,169	202	$1,033
1897	27,293	71,692	155,972	557,046	1,070	3,640
1898	37,490	112,522	212,021	608,784	58	511
1899	51,435	172,540	215,513	632,788		
1900	56,448	232,555	363,202	1,233,921	4	69
1901	75,104	309,594	365,888	1,433,497	1	32
1902	99,485	359,370	402,495	1,720,457	20	57
1903	122,630	414,017	380,038	1,912,459		
1904	123,124	403,570	479,431	2,223,233		
1905	196,008	835,481	550,188	2,228,442	56	479

It is surprising that there should have been such a quantity of so low priced a commodity imported as is shown for coke for 1905, and especially when there is at present an ad valorem duty of 20 per cent upon it. The importations of coke for 1905 were: From Belgium, 6 per cent; Germany, 14.8 per cent; United Kingdom, 18.8 per cent; Dominion of Canada, 60.3 per cent; Mexico, Japan, and British Australasia, collectively, one-tenth of 1 per cent. Of the importations from the Dominion of Canada, 62.5 per cent, or 73,856 long tons came from British Columbia, while the remainder was from Quebec, Ontario, and Manitoba. The export data indicate that the foreign trade in domestic coke is increasing constantly. Domestic coke was in 1905 exported to a considerable number of countries, but principally to the Dominion of Canada, Mexico, and Cuba; Quebec, Ontario, and Manitoba taking 299,203 long tons, or 54.4 per cent, of the total; Mexico, 241,262 long tons, or 43.9 per cent; Cuba, 8,343 long tons, or 1.5 per cent; and 16 other countries, two-tenths of 1 per cent.

Table 15 shows the number of barrels and the value of the crude coal tar and coal tar pitch imported into the United States for each year from 1896 to 1905, inclusive, and the quantity and value of the domestic coal tar which was exported for each year from 1902 to 1905.

TABLE 15.—*Imports and exports of coal tar, crude and pitch: 1896 to 1905.*

YEAR.	IMPORTS.		EXPORTS.	
	Barrels.	Value.	Barrels.	Value.
1896	141,515	$291,862		
1897	111,526	259,490		
1898	88,603	159,988		
1899	25,049	57,853		
1900	74,385	158,255		
1901	37,959	101,044		
1902	32,057	86,294	[1] 14,555	[1] $41,062
1903	56,743	139,393	4,834	15,531
1904	43,732	83,039	6,383	19,284
1905	46,469	115,377	17,643	50,252

[1] Not stated separately prior to 1902.

Table 15 shows a growing though somewhat fluctuating exportation of domestic coal tar. Crude coal tar and coal tar pitch are admitted free of duty under the prevailing tariff act. Nevertheless, it is surprising that the quantity imported should be so large when it is considered that, according to W. H. Blauvelt,[1] 28 per cent of the tar produced in this country in 1905 was burned at the works, because of a lack of demand for it. The foreign coal tar and coal tar pitch imported in 1905 were supplied as follows: Germany, 896 barrels, or 1.9 per cent; United Kingdom, 21,756 barrels, or 46.8 per cent; and the Dominion of Canada, 23,817 barrels, or 51.3 per cent. Of the provinces forming the Dominion of Canada, Nova Scotia and New Brunswick are credited with supplying 18,635 barrels, or 78.2 per cent. The influence of the Otto-Hoffmann by-product ovens at Sydney, Nova Scotia, is thus clearly indicated. The domestic coal tar which was exported in 1905 was dispatched to some 29 different countries, and therefore shipped in small lots. The largest amount, 11,328 barrels, or 64.2 per cent of the total, was exported to Italy; 4,311 barrels, or 24.4 per cent, were sent to the Dominion of Canada; and 11.4 per cent to all other countries.

Table 16 sets forth the values of the coal tar products, which are not medicinal preparations, colors, or dyes, that were imported into the United States during each year from 1898 to 1905. These substances are, under the prevailing tariff act, imported free of duty and, according to the Treasury schedule, include benzol, toluol, naphthalene, xylol, phenol, cresol, toluidine, xylidin, cumidin, binitrotoluol, binitrobenzol, benzidin, tolidin, dianisidin, naphthol, naphthylamin, diphenylamin, benzaldehyde, benzyl chloride, resorcin, nitrobenzol, and nitrotoluol.

TABLE 16.—*Imports of coal tar products, not medicinal preparations, colors, or dyes: 1898 to 1905.*

YEAR.	Value.	YEAR.	Value.
1898	$228,037	1902	$368,098
1899	393,602	1903	425,069
1900	397,780	1904	391,645
1901	383,559	1905	468,352

Some of these substances, like benzol, toluol, naphthalene, cresol, and others are found occurring as such in the crude coal tar and may be obtained from it by distillation, or chilling and expression. Others of these bodies, like nitrobenzol and nitrotoluol, are products of the further manufacture of substances obtained from the coal tar. Some of these bodies, like benzol, may be obtained also from the gas from by-product ovens, and they are so commercially obtained in this country, and are included in Tables 12 and 13 of this report under "unclassified." No information has been obtained as to the countries from which these products are exported, but undoubtedly they are coun-

[1] Private communication.

tries which, like Germany, pursue the economic policy of utilizing labor in working up domestic raw material into manufactured products having an enhanced value.

Table 17 sets forth the quantity and value of the ammonium sulphate, carbonate, and chloride imported into the United States for consumption for each of the years from 1896 to 1905, inclusive.

TABLE 17.—*Imports for consumption of ammonium salts: 1896 to 1905.*

YEAR.	SULPHATE.		CARBONATE.		CHLORIDE.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1896	24,541,396	$480,971	643,621	$40,371	5,338,296	$283,329
1897	19,810,943	336,073	372,466	22,287	4,708,169	217,789
1898	16,413,443	277,531	179,440	10,128	4,002,740	168,613
1899	13,952,127	297,347	150,540	8,405	5,125,644	215,000
1900	16,822,090	423,096	298,788	19,851	5,065,057	214,957
1901	28,971,761	694,454	181,701	12,204	4,772,364	245,163
1902	36,291,938	842,699	280,837	17,308	6,690,551	328,572
1903	33,554,055	852,551	488,283	29,873	6,150,708	308,695
1904	33,333,767	886,403	787,016	52,556	6,841,860	351,768
1905	30,576,558	807,480	463,169	29,746	7,134,343	368,135

The salt indicated as chloride in Table 17 is also known as muriate of ammonia and as sal ammoniac. Besides the salts enumerated, beginning with 1902, there have been reported the following importations of phosphate of ammonia: 1902, 68,750 pounds, valued at $5,065; 1903, 231,867 pounds, valued at $15,650; 1904, 141,610 pounds, valued at $9,065; and 1905. 67,070 pounds, valued at $5,989. No aqua ammonia appears in this decade. The trade in this article seems to have ceased completely, for whereas in 1891 aqua ammonia was imported to the value of $12,858, in 1893 the value was but $718, and there has been no subsequent entry on the record. The various ammonium compounds imported here are obtained usually from bituminous coal, because the chief source of the ammonia in all ammonium compounds is to-day found in the ammoniacal liquor from by-product coke ovens, gas works, and blast furnaces, though synthetic methods of production have been invented and may come into commercial use. To show more fully the relations, the quantity of each of these salts, except the sulphate, which was imported in 1905, was converted into its equivalent weight of sulphate of ammonia, giving 8,707,116 pounds, which, added to the weight of the sulphate of ammonia, imported as such, gives a total of 39,283,674 pounds. The total value of all the ammonium salts imported in 1905 was $1,211,350. Each of these salts is subject to duty, the tariff being for sulphate 0.3 cent per pound, for carbonate 1.5 cents, and for muriate 0.75 cent, while on the phosphate the duty levied is 25 per cent ad valorem. Notwithstanding these duties, and the enormous quantity of ammoniacal liquor that is permitted to escape from beehive and Belgian ovens and to be totally lost, this importation of foreign ammonium salts tends, on the whole, steadily to increase.

Table 18 gives detailed statistics of the coke industry, by states and territories, as reported at the census of 1905. This table shows that the total horsepower for establishments classified under "coke" in 1905 was 75,991. A comparison with the figures for 1900, from which the amount of power of locomotives and pumps has been deducted, since it was not enumerated in 1905, shows an increase of 45,374 horsepower, or 148.2 per cent. The increase in steam horsepower was 30,681, or 105.3 per cent, and in electric power owned and rented 9,047, or 618.8 per cent. In 1905 steam-power was 78.7 per cent of the total horsepower and electric power 13.8 per cent. In 1900 they were 95.2 and 4.8 per cent, respectively. Gas or gasoline horsepower increased from 7 to 150.

TABLE 18.—COKE—DETAILED SUMMARY,

		United States.	Alabama.
1	Number of establishments	278	24
2	Capital	$90,712,877	$3,425,193
3	Land	$8,374,672	$133,242
4	Buildings	$14,235,683	$87,902
5	Ovens	$50,862,467	$2,541,487
6	Machinery, tools, and implements	$8,703,863	$347,893
7	Cash and sundries	$8,536,192	$314,669
8	Proprietors and firm members	73	
	Salaried officials, clerks, etc.:		
9	Total number	1,386	107
10	Total salaries	$1,247,502	$95,518
	Officers of corporations—		
11	Number	187	34
12	Salaries	$309,011	$23,327
	General superintendents, managers, clerks, etc.—		
13	Total number	1,199	73
14	Total salaries	$938,491	$72,191
	Men—		
15	Number	1,154	72
16	Salaries	$918,195	$71,471
	Women—		
17	Number	45	1
18	Salaries	$20,296	$720
	Wage-earners, including pieceworkers, and total wages:		
19	Greatest number employed at any one time during the year	24,652	2,602
20	Least number employed at any one time during the year	16,355	1,492
21	Average number	18,981	2,165
22	Total wages	$9,304,498	$923,983
	Men 16 years and over—		
23	Average number	18,915	2,155
24	Wages	$9,290,216	$921,813
	Children under 16 years—		
25	Average number	66	10
26	Wages	$14,282	$2,170
	Average number of wage-earners, including pieceworkers, employed during each month:		
	Men 16 years and over—		
27	January	17,385	2,264
28	February	17,877	2,386
29	March	18,949	2,408
30	April	19,545	2,449
31	May	19,500	2,472
32	June	19,127	2,457
33	July	16,837	1,693
34	August	17.606	1,743
35	September	19,239	1,880
36	October	19,360	1,988
37	November	20,215	2,031
38	December	21,340	2,089
	Children under 16 years—		
39	January	62	11
40	February	58	12
41	March	62	13
42	April	63	11
43	May	64	11
44	June	68	15
45	July	56	7
46	August	63	2
47	September	68	4
48	October	73	11
49	November	75	12
50	December	80	11
	Miscellaneous expenses:		
51	Total	$4,891,130	$156,902
52	Rent of works	$64,287	$2,000
53	Fire brick, cement, etc., used in repairing ovens	$500,372	$52,859
54	Taxes	$451,082	$16,416
55	Rent of offices, insurance, interest, and all other sundry expenses not hitherto included	$3,873,299	$85,627
56	Contract work	$2,090	
	Materials used:		
57	Aggregate cost	$29,884,532	$3,997,247
	Coal charged into ovens—		
58	Total short tons	36,781,006	4,027,656
59	Total cost	$28,360,121	$3,799,827
	Run of mine—		
	Unwashed—		
60	Short tons	24,872,731	832,754
61	Cost	$17,100,051	$898,081
	Washed—		
62	Short tons	2,649,251	1,256,681
63	Cost	$3,290,181	$1,246,737
	Slack—		
	Unwashed—		
64	Short tons	4,414,326	4,933
65	Cost	$3,403,148	$6,602
	Washed—		
66	Short tons	4,844,698	1,933,288
67	Cost	$4,566,741	$1,648,407
68	Fuel other than charged into ovens	$336,499	$21,837
69	Mill supplies	$274,999	$74,560
70	All other materials	$872,001	$71,683
71	Rent of power and heat	$1,733	
72	Freight	$39,179	$29,340
	Products:		
73	Aggregate value	$51,728,647	$6,175,126
	Coke—		
74	Total short tons	24,733,063	2,335,613
75	Total value	$49,002,051	$5,731,329
	From beehive ovens—		
76	Short tons	22,512,152	1,942,177
77	Value	$42,876,194	$4,933,059
	From retort or by-product ovens—		
78	Short tons	2,216,783	393,436
79	Value	$6,116,278	$798,270

[1] Exclusive of the statistics of 17 establishments making coke, but engaged primarily in the manufacture of other products; these establishments produced 410,225 short tons of coke, valued at $1,302,572.

BY STATES AND TERRITORIES: 1905.[1]

Colorado.	Indian Territory.	Kansas.	Kentucky.	Ohio.	Pennsylvania.	Tennessee.	Virginia.	West Virginia.	All other states.[2]	
13	3	3	6	4	110	9	13	74	19	1
$3,128,136	$116,806	$33,166	$178,686	$583,913	$56,838,875	$733,425	$3,467,449	$8,063,570	$14,143,658	2
$30,200	...	...	$940	$3,668	$6,924,572	$32,250	$451,457	$36,029	$762,314	3
$43,297	$6,500	$800	$10,800	$22,432	$12,214,790	$16,354	$322,137	$621,627	$889,044	4
$2,060,674	$45,000	$21,996	$84,434	$10,200	$28,316,452	$637,980	$1,797,628	$6,320,838	$9,025,778	5
$968,965	$53,806	$4,634	$53,200	$363,100	$3,474,715	$24,792	$507,283	$640,472	$2,265,003	6
$25,000	$11,500	$5,736	$29,312	$184,513	$5,908,346	$22,049	$388,944	$444,604	$1,201,519	7
...	...	...	...	1	72	...	...	...	...	8
36	4	...	4	12	749	39	70	231	134	9
$26,637	$2,810	...	$8,000	$12,504	$733,617	$24,315	$58,147	$160,032	$125,922	10
...	1	...	3	1	71	9	13	35	20	11
...	$250	...	$6,000	$500	$196,798	$7,985	$16,500	$27,123	$30,528	12
36	3	...	1	11	678	30	57	196	114	13
$26,637	$2,560	...	$2,000	$12,004	$536,819	$16,330	$41,647	$132,909	$95,394	14
36	3	...	1	10	637	30	55	196	114	15
$26,637	$2,560	...	$2,000	$11,604	$518,243	$16,330	$41,047	$132,909	$95,394	16
...	...	...	...	1	41	...	2	...	...	17
...	...	...	...	$400	$18,576	...	$600	...	...	18
1,037	111	24	132	153	12,452	476	1,479	3,627	2,559	19
342	79	7	80	73	9,342	347	1,072	2,075	1,446	20
581	90	11	92	113	10,154	377	1,094	2,533	1,771	21
$371,897	$44,013	$5,562	$40,493	$54,343	$5,172,736	$128,568	$440,120	$1,003,592	$1,119,191	22
578	90	11	92	113	10,139	377	1,064	2,525	1,771	23
$370,977	$44,013	$5,562	$40,493	$54,343	$5,168,751	$128,568	$434,963	$1,001,542	$1,119,191	24
3	...	...	...	...	15	...	30	8	...	25
$920	...	...	...	...	$3,985	...	$5,157	$2,050	...	26
124	105	17	121	114	9,081	443	953	2,839	1,324	27
162	92	17	103	114	9,586	436	868	2,749	1,364	28
319	86	17	94	114	10,281	440	921	2,840	1,429	29
451	79	21	105	114	10,628	421	961	2,793	1,523	30
607	79	21	95	114	10,516	412	922	2,654	1,608	31
699	80	10	84	114	10,162	414	890	2,538	1,679	32
768	80	3	74	112	8,950	326	875	2,261	1,695	33
762	83	7	71	112	9,217	321	1,216	2,014	2,060	34
688	89	8	83	112	10,420	324	1,269	2,102	2,264	35
704	94	4	82	112	10,243	319	1,249	2,321	2,244	36
765	102	4	92	112	10,899	326	1,310	2,507	2,067	37
887	111	3	100	112	11,685	342	1,334	2,682	1,995	38
...	...	...	...	...	15	...	29	7	...	39
...	...	...	...	...	15	...	25	6	...	40
...	...	...	...	...	16	...	26	7	...	41
3	...	...	...	...	15	...	27	7	...	42
8	...	...	...	...	16	...	26	8	...	43
5	...	...	...	...	13	...	26	9	...	44
5	...	...	...	...	8	...	27	9	...	45
5	...	...	...	...	14	...	33	9	...	46
5	...	...	...	...	15	...	34	10	...	47
4	...	...	...	...	15	...	35	8	...	48
3	...	...	...	...	17	...	35	8	...	49
3	...	...	...	...	21	...	37	8	...	50
$38,372	$6,000	$305	$7,963	$9,400	$3,363,421	$21,035	$52,643	$369,906	$865,183	51
$1,500	$1,500	...	$89	$500	$27,357	...	$4,970	$25,753	$618	52
$36,442	$3,000	...	$2,494	$225	$321,284	$10,105	$12,877	$36,738	$24,348	53
$125	...	$305	$1,384	$1,650	$330,727	$3,687	$10,238	$32,241	$54,309	54
$60	$1,500	...	$3,996	$7,025	$2,682,208	$7,243	$24,558	$275,174	$785,908	55
$245	...	...	...	...	$1,845	...	...	...	...	56
$985,817	$101,366	$16,392	$21,253	$170,423	$14,978,581	$610,855	$1,183,079	$2,647,482	$5,172,037	57
1,000,206	100,870	10,751	89,395	113,319	23,083,044	573,629	1,676,256	3,628,673	2,477,207	58
$922,394	$93,062	$16,392	$18,698	$169,923	$14,423,048	$582,461	$1,105,432	$2,580,118	$4,648,766	59
26,590	...	...	...	...	20,595,557	1,471	1,297,706	1,413,466	705,187	60
$13,621	...	...	...	...	$12,465,659	$1,681	$845,046	$1,216,904	$1,659,059	61
26,008	...	...	...	...	505,527	192,379	90,141	3,253	575,262	62
$14,485	...	...	...	...	$515,693	$266,206	$58,619	$2,178	$1,186,263	63
297,669	80,870	10,751	14,521	6,796	1,079,682	58,703	288,409	2,063,934	508,058	64
$263,847	$72,062	$16,392	$8,864	$8,017	$816,312	$56,684	$201,767	$1,261,252	$691,349	65
649,939	20,000	...	74,874	106,523	902,278	321,076	...	148,020	688,700	66
$630,441	$21,000	...	$9,834	$161,906	$625,384	$257,890	...	$99,784	$1,112,095	67
$15,500	$600	...	$806	...	$129,322	$7,230	$22,162	$19,143	$119,899	68
$13,993	$7,704	...	$476	$500	$77,229	$4,652	$19,548	$16,433	$59,904	69
$33,930	...	...	$75	...	$347,233	$9,312	$35,937	$30,363	$343,468	70
...	...	...	...	...	$1,733	...	...	...	...	71
...	...	...	$1,198	...	$16	$7,200	...	$1,425	...	72
$1,723,276	$189,861	$20,588	$100,194	$259,058	$28,924,229	$809,801	$1,884,570	$4,174,186	$7,467,758	73
585,662	41,061	6,776	45,112	65,170	16,273.046	324,451	1,139,010	2,282,147	1,635,015	74
$1,723,276	$189,861	$20,588	$100,194	$181,889	$28,593,136	$809,801	$1,882,849	$3,986,081	$5,783,047	75
585,662	41,061	6,776	45,112	23,369	15,767,652	324,451	1,139,010	2,120,791	516,091	76
$1,723,276	$189,861	$20,588	$100,194	$77,385	$27,542,495	$809,801	$1,882,849	$3,502,013	$2,094,673	77
...	...	...	...	41,801	505,394	...	...	161,356	1,114,796	78
...	...	...	...	$104,504	$1,050,641	...	...	$484,068	$3,678.795	79

[2]Includes establishments distributed as follows: Georgia, 2; Illinois, 1; Maryland, 1; Massachusetts, 1; Minnesota, 1; Montana, 1; New Jersey, 1; New Mexico, 2; New York, 2; Utah, 2; Washington, 2; Wisconsin, 2; Wyoming, 1.

TABLE 18.—COKE—DETAILED SUMMARY:

		United States.	Alabama.
	Products—Continued.		
	Coke—Continued.		
	From other ovens—		
80	Short tons	4,128	
81	Value	$9,579	
	Tar—		
82	Gallons	23,074,225	4,081,211
83	Value	$551,836	$91,827
	Ammonium sulphate—		
84	Pounds	26,050,713	5,165,294
85	Value	$681,427	$103,306
	Ammonia liquor—		
86	Gallons	4,339,679	576,664
87	Value	$697,644	$175,707
88	Total amount of gas made, cubic feet	18,761,101,300	
89	Deduct amount used in process or wasted, cubic feet	14,878,300,900	
	Gas sold—		
90	Total cubic feet	3,882,800,400	
91	Total value	$684,464	
	For illuminating—		
92	Cubic feet	3,747,408,300	
93	Value	$668,487	
	For fuel—		
94	Cubic feet	135,392,100	
95	Value	$15,977	
96	All otherproducts, value	$111,225	$72,957
	Power:		
97	Number of establishments reporting	197	17
98	Total horsepower	75,991	3,385
	Owned—		
	Engines—		
	Steam—		
99	Number	686	57
100	Horsepower	59,829	3,075
	Gas or gasoline—		
101	Number	4	
102	Horsepower	150	
	Water motors—		
103	Number	9	
104	Horsepower	188	
	Electric motors—		
105	Number	356	11
106	Horsepower	9,322	310
107	Other power, horsepower	5,315	
	Rented—		
	Electric motors—		
108	Number	27	
109	Horsepower	1,187	
110	Furnished to other establishments, horsepower	112	

BY STATES AND TERRITORIES: 1905—Continued.

Colorado.	Indian Territory.	Kansas.	Kentucky.	Ohio.	Pennsylvania.	Tennessee.	Virginia.	West Virginia.	All other states.	
									4,128	80
									$9,579	81
				778,860	3,815,240			2,160,852	12,238,062	82
				$19,464	$84,812			$54,765	$300,968	83
					1,467,317				19,418,102	84
					$38,733				$539,388	85
				287,063	1,334,775			564,084	1,577,093	86
				$26,440	$190,164			$133,340	$171,993	87
				366,225,000	4,772,401,000				13,622,475,300	88
				291,553,500	4,638,367,400				9,948,380,000	89
				74,671,500	134,033,600				3,674,095,300	90
				$31,265	$11,569				$641,630	91
				74,671,500	35,201,600				3,637,535,200	92
				$31,265	$3,520				$633,702	93
					98,832,000				36,560,100	94
					$8,049				$7,928	95
					$5,815		$1,721		$30,732	96
11	2		4	2	81	6	10	51	13	97
3,806	110		170	350	48,955	405	5,495	3,907	9,408	98
42	2		7	2	404	5	38	60	69	99
3,806	110		170	350	38,308	315	4,755	3,222	5,718	100
						1			3	101
						30			120	102
					8					103
					188					104
					164		14	10	157	105
					4,477		665	400	3,470	106
					5,240		75			107
					10	2		13	2	108
					742	60		285	100	109
									112	110

HISTORICAL AND DESCRIPTIVE.

GEOGRAPHIC DISTRIBUTION.

It is of interest to study the geographic location of coke plants in the United States at different periods, a subject which may perhaps be best initiated by the following quotation from the report of the census of 1880:

At the census of 1860 coke is returned as made in Allegheny, Cambria, Clarion, and Fayette counties, Pennsylvania. These counties are, respectively, in the Pittsburg, Allegheny Mountain, Allegheny River, and Connellsville districts, so that at that date what are now the chief coke producing regions of Pennsylvania were engaged in its manufacture.

A remark similar to that made concerning the statistics of 1850 is also applicable to those of 1860, as coke was doubtless made in other counties of Pennsylvania than those named. In a work published in Pittsburg in 1857 the statement is made:

"The coke iron consumed by the manufacturers of Pittsburg is at present obtained both from a distance and from the neighborhood. The metal of this description made from the fossil ores of the central counties of Pennsylvania is excellent for castings. * * * From the neighboring counties of Fayette, Cambria, Beaver, Mercer, and Lawrence coke metal is now brought to Pittsburg."

This would add Beaver, Mercer, and Lawrence counties to the coke producing sections of Pennsylvania. The Clinton furnace at Pittsburg, working entirely with coke as a fuel, was also blown in during the fall of 1859, and, though small, its consumption of coke would have been a considerable proportion of that reported made in the census year 1860. Altogether, the indications are that the returns for 1860 are very incomplete, as they omit many localities at which coke was made and fail to report much that was made, or do not report it as coke.

In 1870 Ohio for the first time appears in the census as a manufacturer of coke, it being made in Hamilton, Jefferson, and Tuscarawas counties. The coke made in Hamilton county was probably made from the screenings gathered from the different coalyards. In this year, according to the report, coke was made in Pennsylvania in Allegheny, Armstrong, Cambria, Clarion, and Fayette counties, Armstrong being the only county in which coke was reported as made at the Ninth Census in which it was not reported as made at the Eighth.

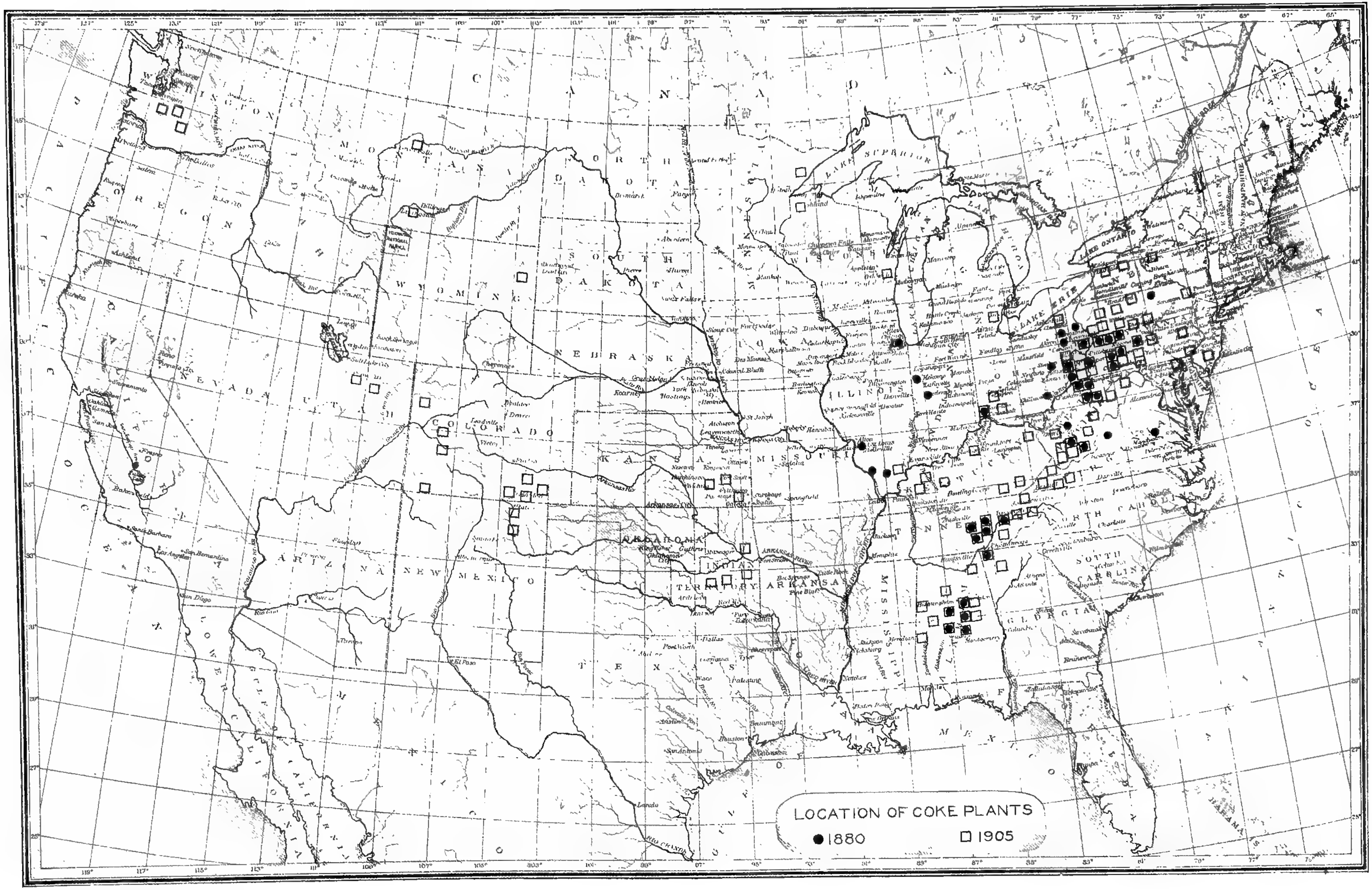
In the census of 1880 it will be noticed that coke is reported as being manufactured in nine states: Alabama, Colorado, Georgia, Illinois, Indiana, Ohio, Pennsylvania, Tennessee, and West Virginia. Two establishments for the manufacture of coke are reported in Virginia near Richmond, but no coke was made in this state in the census year 1879–80. * * *

From an inspection of the map accompanying this report and a comparison of the figures given in the tables showing the localities and production it will be seen that the coke producing belt of the country is the bituminous coal measures of the Appalachian chain. Beginning very nearly at the extreme northern point of the Allegheny mountains in Pennsylvania, the coke ovens follow this range of the Appalachians nearly to their southern limit, at Huntsville, Ala. Outside the limit of this region the make of coke in the census year was but 26,600 tons out of a total of 2,752,475, or less than 1 per cent. It will also be noticed that the center of production is the Connellsville region of Pennsylvania.

No doubt coke in considerable quantities will be manufactured in the future in other states. Already there is promise of this in certain sections of Illinois and in Colorado, but for many years it is probable that the bulk of the coke of the country will be produced along the Allegheny mountain range, from the coal measures of which such a large percentage is now supplied.

In 1890 Indian Territory, Kansas, Kentucky, Missouri, Montana, Utah, Virginia, Washington, and Wisconsin were added to the list of coke producing states and territories. In 1900 Massachusetts, New Mexico, New York, and Wyoming were added, and in 1905 Maryland, Minnesota, and New Jersey. Before 1890 the manufacture of coke was carried on only in states that produced bituminous coal. The Census Report on Mines and Quarries shows that in 1902 no bituminous coal was produced in 5 of the states which have engaged in the production of coke since 1880, namely, Massachusetts, Minnesota, New Jersey, New Mexico, and Wisconsin. However, the location of the coke establishments with respect to the deposits of bituminous coal from which they are supplied can not be set forth accurately by a mere enumeration of the states and territories in which the coke establishments are to be found, for the position of an establishment within a state is often of equal importance. The single coke establishment reported from Maryland in 1905 is located on the shore of Chesapeake Bay, while the bituminous coal mines of Maryland are in the extreme western part of the state. The development of this industry is graphically set forth in the chart facing this page on which the location of works in 1880 is shown by circles drawn on a map of the United States, and the location of works in 1905 is shown by rectangles. By inspection of this chart it is evident that the "coke producing belt" still follows, in the main, the bituminous coal deposits of the Appalachian range, and that as the industry has extended outside this belt it has, to a large extent, been located near other deposits of bituminous coal. Yet, as instanced above, there are marked departures from this rule, including the location of some of the most recently established and most modern plants.

From the study of the history of this industry it appears that in the earlier days coke was used solely as a fuel and reducing agent in isolating iron from its ores, and in working it into marketable forms. The object sought in the coke industry was simply to convert an abundant supply of unsuitable material (bituminous coal) into a material that would bear the burden of the blast furnace. To-day the coke industry not only serves its former uses, but is an important source of those prime industrial factors, heat, light, and power, and, incidentally it furnishes valuable materials in great variety as by-products. Naturally, coke ovens were at first erected and operated in the coal fields close to the source of supply, and, as pointed out, this custom still prevails to a considerable extent. It was one factor determining the location as the industry extended; but with the growth and improvement in transportation facilities,


LOCATION OF COKE PLANTS
●1880
□1905

and especially with the rapid increase in the coal-carrying capacity of railroads per unit of power expended, it was found that, while still practicing the art in the old way, there was an economic gain in transporting the compact coal rather than the more bulky coke, notwithstanding the loss of a large percentage of the coal in coking. The practice thus grew of locating coke ovens near blast furnaces and other points of consumption; a practice which was already begun in 1880. With the introduction of by-product ovens this advantage in transporting the coal to points where not only coke, but the by-products, could be used most economically was emphasized, and in recent years coke plants have been located not only near blast furnaces and steel works, but at chemical works also, and recently near great centers of population fairly remote from coal fields, where they have come into active competition with gas companies in supplying gas for light and heat and where the coke is used largely as a domestic fuel. Thus, in speaking of the by-product establishments in operation in the United States in 1903, Pennock says:[1] "Of the 20 plants, 16 are located near blast furnaces, 2 at soda ash plants, and 2 are built adjacent to cities which are supplied with illuminating gas. Of the 16 plants located at blast furnaces which are supplied with coke 8 also supply gas for illuminating purposes."

PROCESS OF MAKING COKE.

Bituminous coal is converted into the coherent, carbonaceous substance called coke by a process of "dry" or "destructive" distillation, in which its volatile portions are driven off from the main body. The operation is carried on in the United States in beehive ovens, in Belgian or flue ovens, and in by-product ovens. Coal was formerly coked in heaps, piles, or mounds, or in open kilns, but these methods have become obsolete in this country. They are described in detail, and accompanied by illustrations in the Report on the Manufacture of Coke of the census of 1880. This report also treats at length of the beehive and Belgian ovens, so it will suffice to refer but briefly to these types here, especially as in their main features they remain practically unchanged to-day.

Beehive ovens.—The beehive oven is built of brick or stone, is cone-shaped in the interior and has an exterior the shape either of a rectangular prism or with one or more of the sides slanting inward from the base. Coal is poured in and the gases escape through an opening in the top, while the coke is taken out through an opening in the face of the oven near the base, which also permits the proper amount of air to enter. To facilitate the withdrawal of the coke, the bottom of the oven is usually inclined toward the front. The standard ovens, designed by John Fulton, and used in the coking tests by the United States Geological Survey at St. Louis in 1904, were 12 feet in diameter and 7 feet in height. They are usually built in batteries for economy in construction, operation, and heating, and frequently two batteries are placed back to back within the same inclosing walls. The coal is charged into the oven through the top opening from a car or larry running on tracks resting on the filling above the oven dome, and then is leveled off by a rake worked by hand or sometimes by a mechanical leveler, after which the door is closed by bricking up, leaving a few interstices and a small air space at the top above the level of the coal charge. The heat remaining in the oven brickwork from previous operations or from a preliminary heating up starts the distillation, and the evolved gas becomes ignited and burns with the air entering at the interstices in the door. By this means the arched dome of the oven is heated, and it reflects and radiates heat upon the coal below, thus continuing the decomposition until only coke remains. When the gas is burned off, water is turned into the furnace to arrest combustion and to give the coke a silver-gray luster, and the coherent mass is cracked so that it may be withdrawn. The coke is then drawn from the oven by hand rakes or by machinery, and the operation is repeated. The charge of coal used is from 4½ to 5 net tons of coal for a 48-hour coking period and somewhat more for a 72-hour coking period, but in either case the oven is only partly filled by the coal, leaving a large space above it. The coking periods are usually so arranged as to avoid drawing coke on Sunday, two 48-hour charges and one 72-hour charge constituting a week's work. During the coking the coal gives off in the gas quantities of heavy hydrocarbons, which, in burning at the upper opening of the oven, emit great volumes of dense smoke.

Belgian ovens.—The term "Belgian ovens" includes a number of forms of coke ovens, among which may be enumerated the Dulait, the Coppée, and the Appolt. They differ radically from the beehive ovens in three particulars: (1) In the exclusion of air from the coking chamber, the heating necessary for coking being applied from the outside; (2) in the utilization of the waste heat and gases to facilitate the process of coking; (3) in their operation. Coking in beehive ovens proceeds from the top of the charge of coal downward, the heat is supplied by the combustion of the gases evolved from the coal and of part of the coal itself within the oven, and the coke is also quenched in the oven. Coking in Belgian ovens, on the other hand, proceeds simultaneously from the sides, bottom, and top of the coal charge inward toward the center, the heat necessary being supplied by the combustion in flues in the walls of the oven, of the gases of distilla-

[1] V. Internationaler Kongress für angewandte Chemie, vol. 2, page 781.

tion previously collected, and the coke is quenched outside the oven.

The various types of Belgian ovens above enumerated differ in features of construction and in the arrangement of their flues. The Coppée oven, which is one of the best known, may be taken as an example of all. These ovens are built of brick in pairs, so that one may be charged as the other is ready to be discharged, and these pairs are grouped in batteries of thirty. Each oven is 26 feet 6 inches long, 4 feet high, and varies in width from 19 inches at the discharging end to 17 inches at the front. Connected with each oven are a number of vertical flues through which the volatile products of both ovens of a pair are conveyed downward to a horizontal flue under one of them. Then, after passing the length of this oven, the gases return by a similar flue under the other and enter a channel running at right angles to the ovens and under them, passing from this channel either directly into a chimney or under boilers where they are used to generate steam. Air is supplied to these vertical flues in the sides of the ovens by smaller vertical flues, there being one or two to each oven, connected with the top near the center charging hole, the air becoming heated while passing through the flue.

The ovens are charged through three hoppers in the top and are drawn by means of a mechanical ram propelled by a cogged driving wheel worked by a small portable engine. At each end of an oven are two iron doors moving on hinges and fixed securely in metal frames, the lower 3 feet high, the upper 1 foot. In working the ovens it is necessary first to heat them thoroughly, which is done by lighting fires of coal close to the doors at the end of every oven. When the ovens are sufficiently hot, they are charged. The first few charges of coal are in small lumps, the coke produced being of an inferior quality; but in a few days the ovens become so thoroughly heated that crushed coal of the consistency of very coarse meal is used, it being washed, if necessary, to remove impurities. When the charge is to be withdrawn, the front and back doors are opened and the mass of coke pushed out by a ram. The ram is quickly withdrawn and the two lower doors are closed. The oven is then charged immediately through the hoppers or openings in its top, and the coal is leveled with rakes by two men working through the upper doors at each end. The doors are then closed and carefully luted, and carbonization commences immediately. The processes of discharging and charging the ovens need not occupy more than eight minutes. The coke is quenched immediately on being withdrawn. Six charges are coked in each oven per week, each charge yielding about two tons of coke.

Weeks records the building of 80 Coppée ovens in 1880 at Goshen Bridge, Va., by the Iron and Steel Works Company of Virginia to coke coal from the New River region, West Virginia, and the operation of Belgian ovens in Illinois as early as 1872.

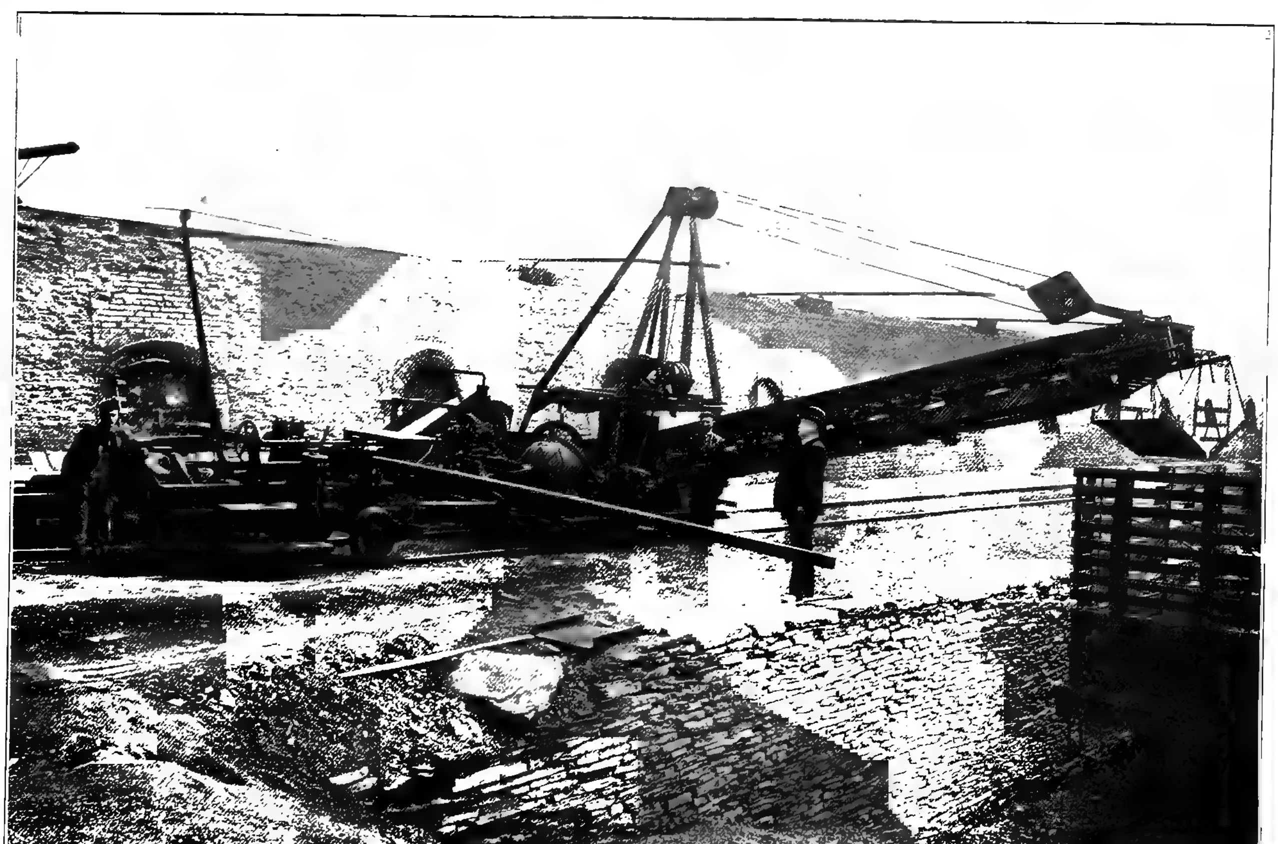
BY-PRODUCT OVENS.

In the "beehive" and Belgian ovens no effort is made to save any portion of the matter volatilized, yet the possibility of effecting this saving has long been known, for Goethe states that in 1771 Stauf, near Saarbrücken, endeavored in his "connected row of furnaces" to "cleanse the coal from sulphur for use in iron works" and "also turn the oil and resin to account, not even losing the soot," but that "all failed because of the many ends in view." According to Blauvelt, "It was not until 1855 that Pauwels, Dubochet, and Carl Knab, working on different lines, successfully operated coke ovens where the tar and ammonia were saved. A few years later Carvés added side flues to Knab's design, and the by-product oven in its essentials became a fact, although it was not until 1881 that the condensation of ammonia and tar was a success along with the production of a good quality of coke." This Knab-Carvés oven was the progenitor of the Semet-Solvay by-product oven, while the Coppée oven was the forerunner of the Otto-Hoffmann by-product oven. In the Census report for 1880, Weeks gives a detailed description of the Siemens, or Simon-Carvés, oven as operated at Bességes, France, by the Terrenoire Company from 1867 to 1879, showing for each year the number of ovens operated and the yields. In 1879 they operated 96 of these ovens, coking 46,900 tons of coal and producing 33,092 tons of coke, 1,099 tons of tar, and 4,393 tons of ammoniacal liquor. The yield of coal in coke was 75 per cent. No gas is accounted for, and about 35 pounds of "small fuel" was burned for each ton of coke produced. An itemized statement of cost of constructing 100 Carvés ovens is given, the total reaching about $192,442.

The first known mention of the utilization of by-products from coking in the United States is the statement in the census of 1880 that the Consolidated Gas Company of Pittsburg collected the gas from beehive ovens and distributed it for lighting purposes. The first plant of modern by-product ovens built in the United States was a battery of 12 Semet-Solvay ovens erected at Syracuse, N. Y., in 1892.

Characteristics of by-product ovens.—By-product ovens, such as are in use in the United States, are narrow rectangular cells with openings the full size of the cross section of the cells at either end, which, when in use, are closed by slab-like doors that may either slide vertically in grooves or be wholly detachable, and when put in place are sealed by luting with clay or by other means to make them gastight. These ovens are built largely of refractory brick, in batteries or blocks to prevent, so far as possible, loss of heat by radiation and convection, for when they are so built the heat of the adjacent ovens is necessarily interchanged. The coal

BEEHIVE OVENS AT UNIONTOWN, PENNSYLVANIA.



COKE DRAWER AND LOADER FOR BEEHIVE OVENS.

in the ovens is carbonized by the heat produced by the combustion of gas in flues placed in the partition walls which divide the ovens in the battery, so that the process is one of destructive distillation pure and simple. The battery is placed above two systems of flues or regenerators. Through the first the combustible mixture of gas and air is led in to the combustion flues in the side walls of the oven. Through the second the gaseous products of combustion are led out to the chimney stack. By this arrangement some of the heat carried out by the products of combustion is utilized in heating the ingoing gases, thus not only effecting a saving of fuel, but also furnishing a higher temperature at the point of combustion than could be obtained if cold gases were used.

In the upper part of each oven are several openings through which the coal may be dropped in charging the ovens. In the top of the ovens are openings connected with mains through which the volatile substances produced by the distillation pass out and are carried to various reservoirs as they are separated by condensation into gas, ammoniacal liquor, and tar. These openings are usually at the extreme ends of the ovens just inside the doors. Where the gas produced is used as fuel gas only, there is but one of these openings and one set of mains, but where part of the gas is used for illuminating purposes and part for fuel, there are two openings and two sets of mains, so that during the first part of the heating, when rich gas is produced, this may be drawn off through one of the mains, and later when the lean gas is produced, this may be drawn off through the other main. In ovens of the class described the gas used for heating is a part of that produced in the distillation of previous charges of coal, but before it is used as fuel it is cleansed by scrubbing and condensing, as in the manufacture of coal gas.

As this process involves not only the production of coke but also the recovery and utilization of the gas, ammonia, benzol, and tar, a by-product plant includes not only the batteries of ovens, with their system of heating and the necessary ducts and mains, but also a recovery plant. First in importance in this system are the exhausters, which remove the gas from the ovens, draw it through the mains and cooling apparatus, force it through the scrubbing apparatus and deliver it to the combustion flues under pressure, or in case of rich gas, to the purifiers and storage gas holders. The control of the gas passing through the system centers in the exhauster room, and here is placed the gauge board on which are placed the pressure and vacuum gauges, which indicate the existing conditions in the various apparatuses. The exhauster is used because the slight pressure which is maintained in the ovens at all times, to prevent the leakage of air into them, is so variable that it would be unwise and undesirable to depend upon it to force the gas through the system.

First in order in the apparatus used in the treatment of the distillates come the air coolers, through which the gas is led to and fro in ascending zigzag passages, exposing large surfaces to atmospheric cooling. A number of these cooling units are arranged in parallel, so that any one of them may be taken off for cleaning or repairing without disturbing the operation of the remainder. They may be provided with an exterior sprinkling system, so that water cooling may be used in hot weather, when necessary, thus adding to the flexibility of the system. Next come the water coolers, which are rectangular in shape and filled with tubes to carry the water. The gas space is divided by successive baffles, so that a tortuous path is followed, and the circulating water is made to flow through the tubes in a parallel but opposite direction to the gas. After the gas has passed the air and water coolers, it is delivered by the exhauster to the tar scrubbers, where the tar which exists in finely divided particles in suspension in the gas, like a mist, is removed through friction and deposited in globules, by the passage of the gas through small openings in a series of thin steel diaphragms. When the coal yields considerable naphthalene which may plug these openings, other devices must be employed. After the tar scrubbers follow the ammonia scrubbers, which, in the tower type, contain a latticework of wooden slabs, over which the water trickles downward while the gases rise; and then come the purifiers, which are rectangular boxes, containing perforated trays holding layers of lime or Laming's mixture, by which the sulphur and carbon dioxide are removed from the illuminating gas. Then follows the ammonia-recovery plant, where the weak ammoniacal liquor is converted by distillation into concentrated crude liquor or into ammonium sulphate, and the benzol-recovery plant, where benzol is obtained from the lean gas by scrubbing it with dead oil. To these should be added the necessary gas holders, tar tanks, ammonia tanks, and other receptacles for holding the various materials and products, and sheds and appliances for storing and handling the coal used and coke produced.

Naturally, where the operations are conducted on so large a scale, it becomes possible to do by machinery much that in small plants is done by hand, and this is one of the economic advantages of the by-product plant. The mechanical appliances may perhaps be best referred to in a description of the method of operation.

Method of operating by-product ovens.—The coal is carried by conveyors from the storage pit to the storage bin above the battery of ovens, where it is drawn through chutes into the larry, which travels on rails over the top of the battery. The doors of an oven having been closed and the oven having been heated, the manholes in the top of the oven are uncovered and the larry brought over the oven, so that the coal in the larry may be discharged into it. Through an opening

in one of the doors the charge is leveled by a leveling bar, the oven is then sealed up, and the valve leading to the gas main is opened. When the coking period has elapsed, the valves to the mains are closed, the doors on either end of the oven are removed, and the charge is forced out by a ram or pusher, which traverses the oven and pushes the coke out onto a wharf or into a car on the farther side of the oven, where it is quenched by a stream of water.

To obtain water cooling the coke in some cases is received in a specially devised quencher, which consists of a rectangular box with cast iron cellular walls. It is large enough to take in the whole oven charge and its bottom is formed of a motor-driven chain conveyor. The whole machine travels on rails parallel to the oven battery, and connection is made with the particular oven to be pushed by means of swinging doors and a drop bottom, which, assisted by the moving conveyor bottom, guides the coke charge to the conveyor. When the charge is received, the doors are closed and the coke is quenched with water. The immediate and violent generation of steam is taken care of by escape stacks. The whole receptacle is filled with steam, practically excluding the air, and the silvery gray color, characteristic of beehive coke, is thus obtained. When the quenching is complete, the coke is discharged into a car on the adjoining track.

The coal used in these ovens is fine coal, which not only facilitates charging but also permits the charge to pack closely, whereby the density of the resulting coke is improved. A modern practice in Europe for coals which had failed to produce a coke of sufficient density or strength is to compress the charge into a cake before loading it into the oven. In this case the coal is ground to the size of rice and moistened, so that it will cake slightly when compressed in the hand. It is then fed into a box somewhat narrower than the oven and stamped, layer by layer, by two or more stamps, which in some cases travel back and forth in the box and in others remain stationary while the box moves to and fro. When the box is full the coal has been compressed about 25 per cent. The box is now run onto a transfer car attached to the pusher, and then taken to the oven, where the sides of the box are removed and the coke pushed into the oven. The stamping of the coal prevents the formation of the spongy coke produced by certain coals and improves the physical structure as well. The process is not, however, advantageous for all coals, it being held that, when employed on coals which ordinarily produce a dense coke, the grain is made too close. A few installations for this method have been made in this country, but it has not as yet been generally adopted here.

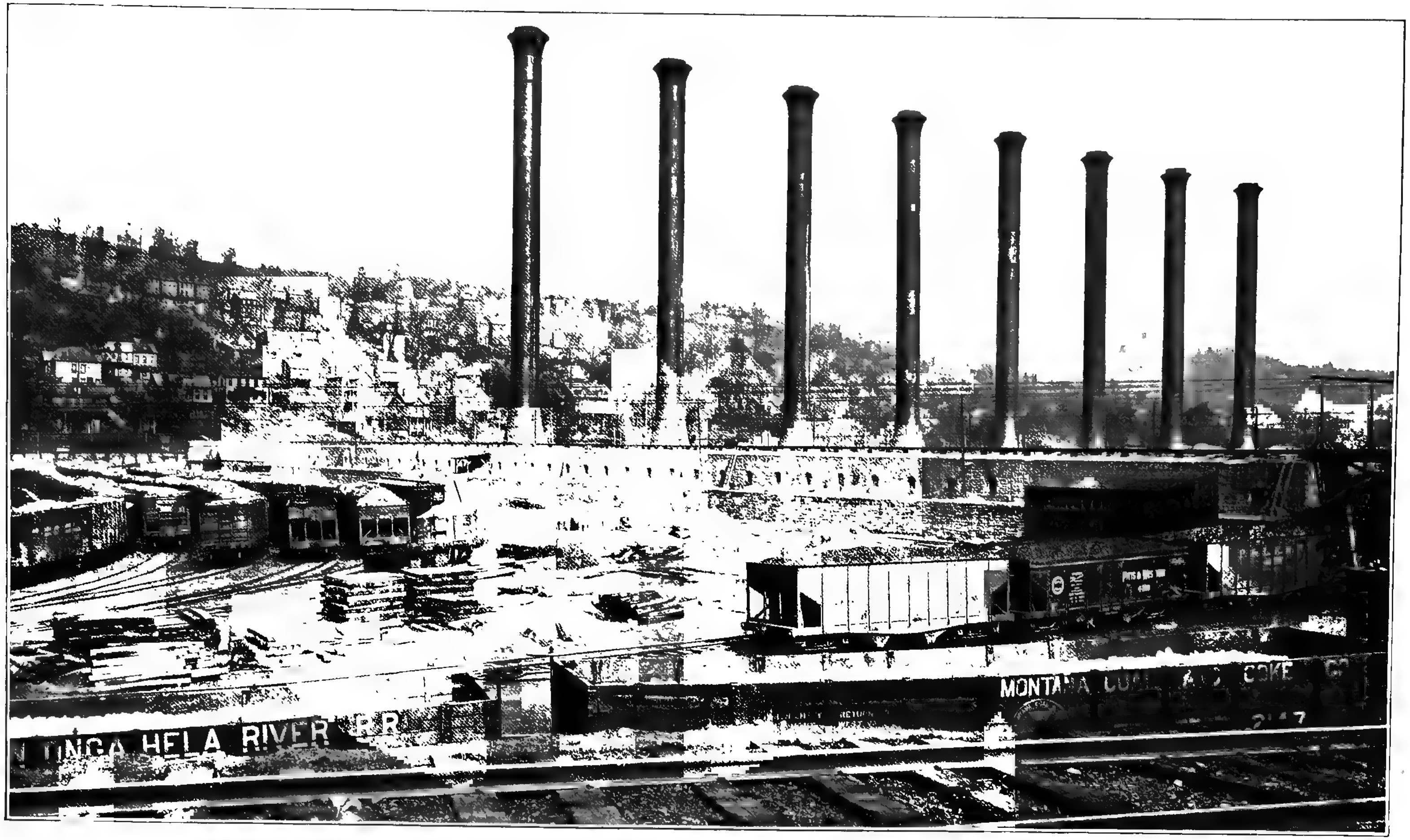
Semet-Solvay by-product ovens.—The first Semet-Solvay ovens, 6 in number, were built for experimental purposes in 1882, near Mons, Belgium, and the results were so satisfactory that their use spread. In 1892 a battery of 12 ovens was built at Syracuse, N. Y., to which shortly after 13 more were added. This was the first plant of by-product ovens erected in the United States, but by January, 1906, there had been built or were being built in the United States 13 plants of Semet-Solvay ovens, embracing 1,295 ovens. The locations of these plants, the number of ovens in each plant, the character of the coke produced, and the use to which the gas is put is shown in the following statement:

Semet-Solvay by-product ovens built or building in the United States, January, 1906.

LOCATION.	Number of ovens.	Kind of coke.	Use of gas.
Syracuse, N. Y.	40	Kiln, foundry	Fuel.
Dunbar, Pa.	110	Furnace	Fuel.
Sharon, Pa.	25	Furnace	Fuel.
Ensley, Ala.	240	Furnace	Fuel.
Wheeling, W. Va.	120	Furnace	Fuel.
Detroit, Mich.	120	Furnace, foundry, domestic	Illuminating.
Chester, Pa.	40	Domestic, foundry	Illuminating.
Tuscaloosa, Ala.	40	Furnace	Fuel.
Milwaukee, Wis.	160	Furnace, foundry, domestic	Illuminating.
Lebanon, Pa.	90	Furnace	Fuel.
Geneva, N. Y.	30	Foundry, domestic	Illuminating.
Chicago, Ill.	160	Furnace, foundry, domestic	Illuminating.
Steelton, Pa.	120	Furnace	Fuel.

As marking the progress it may be noted that in 1893 the standard block of Semet-Solvay ovens was 25 ovens, having a coal capacity of 4.4 short tons each, or a total of 110 tons; in 1903 the standard block was 40 ovens, having a coal capacity of 7 to 9 short tons each, or a maximum of 360 tons; and in 1905 the standard block was 80 ovens, having a coal capacity of 9 short tons each, or a total of 720 tons. The length of the ovens has increased from 30 to 35 feet, and the height from 5½ to 9 feet, but though greater widths have been tried, an average of 16½ inches has been found most advantageous. The number of flues in the side walls in 1893 was three, in 1903 four, and 1905 five, the ovens being consequently spoken of as three high, four high, or five high. The time required for the treatment of a charge in 1893 was twenty-six hours; in 1903 the average was twenty-four hours; in 1905 it was eighteen hours; the shortening of the time being attributed to the introduction of machinery for charging and discharging the ovens and to the use of higher heats. The entire operation of discharging, charging, and sealing up an oven does not now occupy over fifteen minutes.

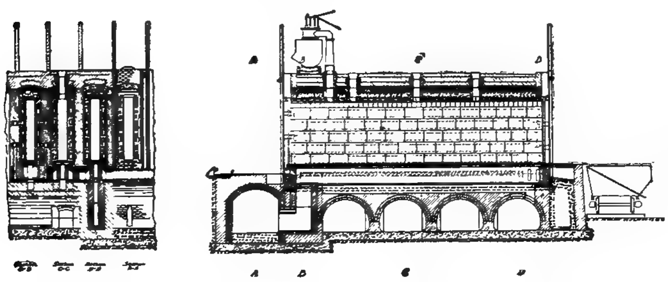
The Semet-Solvay system is distinguished by the use of horizontal flues formed either with small bricks or with hollow fire brick tiles; and by a special means for preheating the air for combustion, and sometimes the combustible gases also, by the waste gases of combustion. The hollow fire brick tiles are about 3 feet long and, placed end to end, they form the flues, while placed one on another, they form the facings of the side walls of the ovens. The flues are connected by an opening in the bottom placed near one end of each flue,



BEEHIVE OVENS OPERATED IN CONNECTION WITH LARGE STEEL PLANT AT PITTSBURG, PENNSYLVANIA.

so that gases and flames may traverse the entire length of all the flues. To heat the ovens, in a four high oven for instance, gas is admitted at the ends of three of the four flues and meets hot air from the recuperators below. The flame travels along the entire series of flues, from above downward, being reinforced at each point of gas supply until it reaches the bottom of the oven, and thus absolute control of the temperature at any point is obtained. At the bottom of the oven the currents of gases from the several flues meet, pass through a series of channels with thin walls, thereby preheating the air for the combustion of the gas above, and out to the chimney flue. On the way to the stack the gases pass through water-tube boilers where they raise part of the steam for operating the plant, although the temperature of the flue before the boilers is not above a dull red, and is often entirely black. Nevertheless, the volume of the gases is large and generates considerable steam. This utilization of the waste heat of the combustion gases effects a considerable economy, as a large volume of steam is required in the treatment of the ammoniacal liquors. The air for supporting the combustion is drawn in by a chimney draft through a

Longitudinal cross section of five high Semet-Solvay ovens.



flue, where it is heated to a temperature of from 200° to 500° C. by gases of combustion which pass out in the flue below the oven. The air is admitted to oven flues and regulated by dampers so nicely and the gas supply is under such control that combustion takes place with the minimum amount of air and the temperature of the flues may be maintained at will from 900° to 1,400° C.

The advantage claimed for the Semet-Solvay method of construction is that the hollow flues forming the walls of the oven are entirely independent of the side walls. These side walls, made of fire brick, carry the huge mass of brickwork, coal cars, etc., above the oven proper and thus relieve the flue-structure bricks from all strains and thrusts, which would have a tendency to displace them, causing leaks deleterious to the gas and other products. Because of the freedom from burden, the oven sides of the flues can be made much thinner than they otherwise could, so that they conduct the heat from the flue where the combustion of the gas takes place to the mass of coal in the oven more advantageously. The thick side walls and the mass of brickwork above serve to hold the heat, giving it up to the oven during the time of discharging and charging, thus preventing any chilling of the oven. An expansion space above the oven permits the tile to expand without affecting the main body of brickwork. Moreover, the horizontal arrangement of the flues and the admission of the gas at several points permit an easy control of the temperature of all parts of the coking chamber, and a ready inspection of the whole length of every flue to determine whether the temperatures are controlled and distributed properly. This point is of great importance, since it insures the whole mass of coal being thoroughly coked, and in the minimum time, without any danger of overheating any part of the oven structure. In fact, a uniform and accurately controlled temperature in the oven chamber is essential to the best coke in the shortest time.

Otto-Hoffmann by-product oven.—In 1881 the firm of Dr. C. Otto & Co. constructed and exploited in Germany an oven in which Siemens' regenerator was employed to recover the heat from the waste gases and to furnish heated air for combustion, the oven construction being of the Otto-Coppée type, then well known. This form of oven met with such acceptance that by 1894 over 1,200 of them had been constructed on the continent of Europe. In 1894 the first plant of this type was erected in the United States, a battery of 60 ovens being built for the Cambria Steel Company at Johnstown, Pa., to produce coke for use in its blast furnaces. This was therefore the first by-product oven plant operated in conjunction with a blast furnace in the United States. Since this date there has been a steady increase in the number of Otto-Hoffmann ovens, as is shown in the following statement:

Otto-Hoffmann by-product coke ovens built or contracted for in the United States: 1905.

LOCATION.	Number of ovens.	Use of coke.	Use of surplus gas.
Johnstown, Pa	372	Blast furnace	Fuel and power.
Glassport, Pa	120	Blast, domestic	Illuminating, fuel.
Everett, Mass	400	Domestic, locomotive.	Illuminating, fuel.
Hamilton, Ohio	50	Foundry, domestic	Illuminating, power.
Lebanon, Pa	232	Blast furnace	Fuel.
Buffalo, N. Y	[1] 564	Blast furnace	Fuel.
Camden, N. J	100	Foundry, domestic	Illuminating, power.
Camden, N. J	[1] 50	Foundry, domestic	Illuminating, power.
Sparrow Point, Md	200	Blast furnace	Illuminating.
Wyandotte, Mich	15	Limekilns	Fuel.
Wyandotte, Mich	[1] 15	Limekilns	Fuel.
South Sharon, Pa	212	Blast furnace	Fuel.
Duluth, Minn	50	Blast furnace	Illuminating.

[1] Not completed.

The Otto-Hoffmann system is distinguished by the use of vertical flues in the side walls of the ovens or retorts and the utilization of the Siemens' regenerator. The ovens or retorts of the usual rectangular form were built at first in batteries of 30 and later of 50. The ovens are 33 feet long, 6½ feet high, and from 17 to 22 inches wide, their capacity being from 6 to 7 net tons of coal. The walls of the ovens are sometimes built to

taper, so that the oven is wider at the discharging end than at the pushing end. This taper varies from 4 inches for swelling coals to 1 inch for those of a shrinking nature. The side walls are provided with vertical internal flues, through which the ovens or retorts are heated. The heating of the oven is done by gas, returned from the condensing house through lines running along each side of the battery, there being a burner at either end of each oven. Only one burner is used at a time. The air for combustion is taken in at the end of the battery where the gas and air reversing valves are located, and is led through underground passages to flues beneath the regenerative chambers. These chambers extend the whole length of the oven battery and are filled with checker brick. The air rising through this checker work is heated to a high degree and then passes through uptake connections to the space beneath the floor of the oven chambers, and thence through lateral ports to the combustion chamber, where it meets the gas from the burner. The burning gases rise through the vertical flues of half the oven wall, pass along the horizontal connecting flue above, and down the remaining vertical flues to the horizontal flues below, thence passing to the regenerator, where their sensible heat is absorbed by the checker work. From there they are led to the lower regenerator flue, past the reversing valve, to the draft stack. On the reversal of the air and gas the gas burner at the other end of the oven comes into use, the air passing up through the heated regenerator on that side to the gas burner and combustion chamber, the heated gases passing in the reverse direction through the wall flues, downward through the regenerator and so to the stack. The period of reversal is usually thirty minutes.

United-Otto by-product ovens.—The United Coke and Gas Company, in its work of erecting the Otto-Hoffmann plants in the United States, has modified the original design so much that it is now building a new oven, known as the United-Otto oven. The principal change involved is the adoption of the under-fired principle, which makes it possible to heat a longer retort of greater capacity than heretofore, and also makes each oven battery an economical unit without the use of an auxiliary steam boiler to absorb the heat from the combustion gases. The construction is described in the following statement, which was kindly supplied by this company:

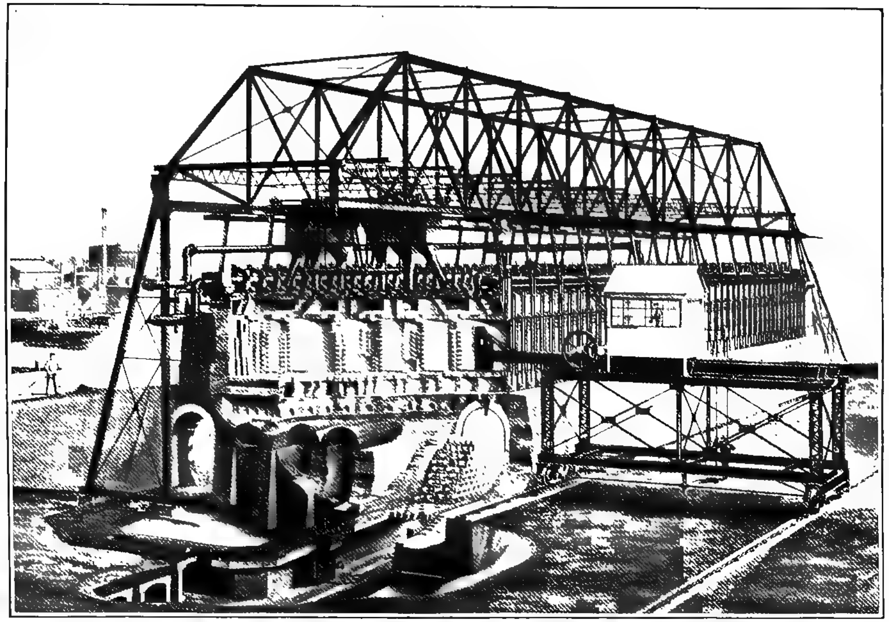
The oven itself is a rectangular retort from 33 to 43 feet long, 7 to 9 feet high, and 17 inches in width, the dimensions varying with the characteristics of the coal that is to be used. The retort walls, top and bottom, are composed of refractory material, and the masonry is supported on a steel and concrete substructure, so as to be entirely independent of the regenerative chambers below. This avoids the cracking of the oven walls and the consequent loss of gas, liable to occur from the expansion and contraction of the heated regenerator walls beneath the oven structure. Access is also given to all parts of the oven for inspection and incidental repairs. The open substructure admits of a complete anchoring system joining the buckstays above and below, and holding the oven walls securely in place. The steel work of the substructure is protected from the heated brick work above by a course of hollow tile, which also serves to retain the heat in the ovens. The oven chamber is closed at either end by doors, which are of the self-sealing type, replacing the older form of clay-luted doors. These do away with the labor of mixing and applying the luting clay, which has hitherto formed a large item in the operating expenses.

The construction of the oven walls is a point of vital importance. Shaped brick of the best grade of refractory material of moderate size and simple design are used, complicated and irregular shapes and those of large size being avoided as being more liable to cracks and distortion. The time honored methods of laboriously chipping bricks of uneven thickness to form an even course in laying the oven walls has been abandoned entirely, and all cutting is done to exact dimensions by large carborundum grinding wheels, which economize the high-priced mason's labor and result in a quality of workmanship far beyond anything previously considered possible. This results in a practically gas tight wall of great strength.

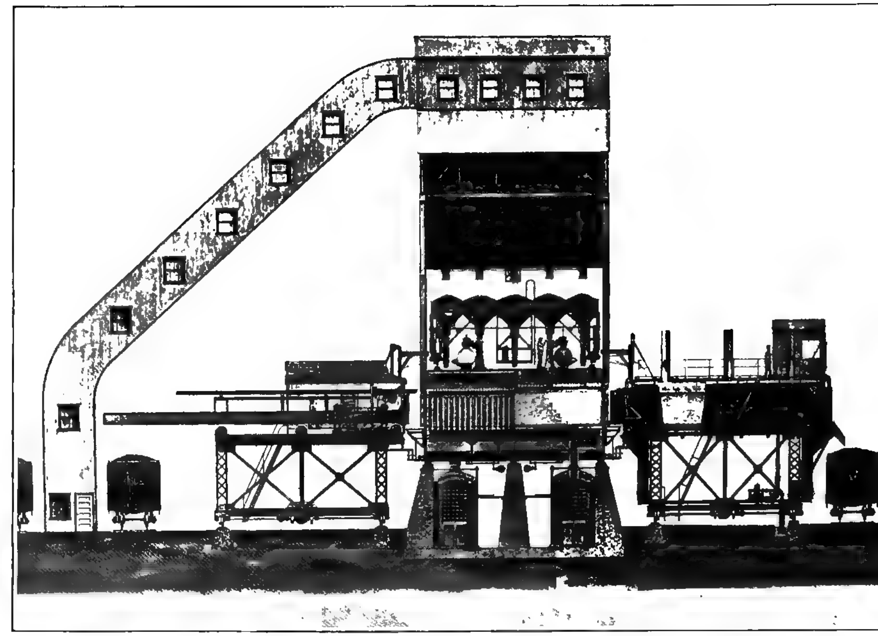
The resistance of the wall is enhanced by the vertical flue system, as the heating flues run perpendicularly along all that portion of the oven wall against which the coal can exert any pressure. The divisions between the flues form vertical strengthening ribs and tie the wall into a single homogeneous whole. This is of vital importance when coals of only slightly shrinking or even expanding nature are to be coked, such as are used at the Cambria plant. The greater unsupported wall areas necessarily exposed to the pressure exerted by this coal in a horizontal flue system is liable to result in bulging of the side walls and destruction of the oven. A great advantage of the vertical flue construction is its ability to withstand the compression loads due to the weight of the oven superstructure, thus doing away with the necessity of supporting walls built between the heating flue systems of each adjacent oven, and decreasing the cost of the masonry, as well as saving 33 per cent of the space required for a given block of ovens.

The heating of the ovens is accomplished, as in the Otto-Hoffmann oven, by the use of gas returned from the condensing house. The air for combustion is supplied to the regenerator by a fan, this method aiding in the equal distribution of the air to each oven and reducing the amount of stack draft necessary. This not only allows the use of a smaller stack but makes a more even balance of the pressure in the flues and diminishes the loss of gas from an oven should a leak occur in the division wall. The gas is admitted through a burner at each end and four or six burners in the bottom, placed symmetrically on each side of the middle line. This avoids the use of bottom burners above the regenerative chambers, where they are less easy of access for cleaning and regulation. At the same time it makes it possible to heat properly ovens up to 43 feet in length, instead of 33 feet, which was the limit of the Otto-Hoffmann oven heated with the end burners alone. This results in an increase of oven capacity of approximately 50 per cent, and a corresponding saving in the operating cost per ton of output. The surface of the checker brick in the regenerators is so proportioned as to render the most efficient service in absorbing the heat from the waste gases, at the same time avoiding unnecessary cost in installation. The temperature of the waste gases leaving the regenerators is not high enough to cause deterioration of cast iron reversing valves of the usual form.

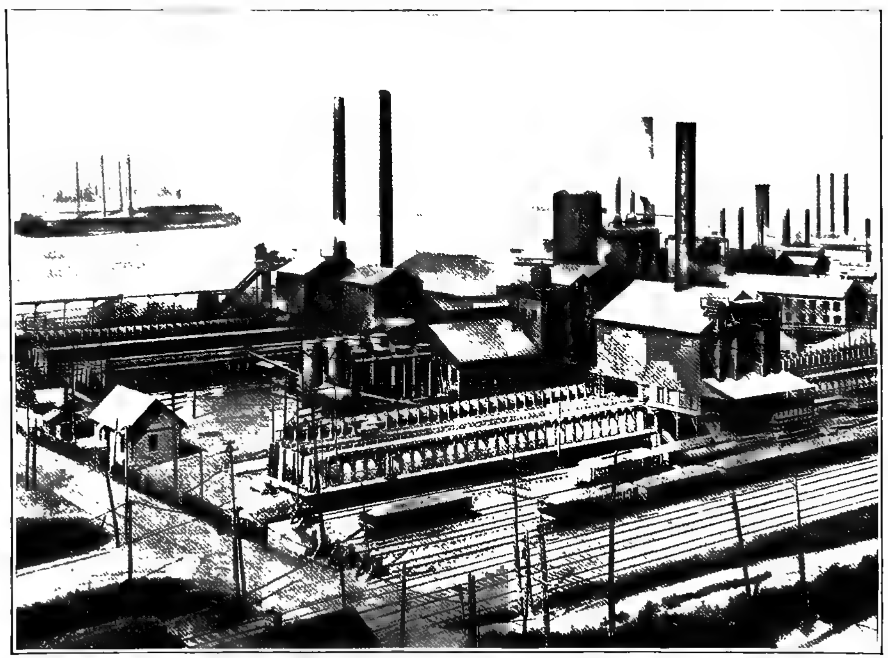
Rothberg oven.—The Rothberg oven consists of a long, narrow, rectangular coking chamber about 16 inches wide, 6 feet 4 inches high, and 33 feet long, closed at both ends with cast iron doors lined with brick. It is of the horizontal-flue type, one set of flues serving two adjacent ovens. In the center of the flue system is a vertical wall which divides it into separate parts. The oven, as built at Buffalo, has 5 horizontal combustion flues in each part, with a recuperator



SECTIONAL VIEW OF OTTO-HOFFMAN OVEN.



SECTION OF UNITED-OTTO PLANT.



SEMET-SOLVAY OVENS AT DUNBAR, PENNSYLVANIA.

SEMET-SOLVAY OVENS AT WHEELING, WEST VIRGINIA.

flue for preheating the air above. At the end of each combustion flue is a burner connection for supplying gas and also a damper to regulate the amount of flame. The method of operation is as follows: Free air is admitted through openings in the top to the recuperator flue, where it is heated, and then it meets the gas at the end of the combustion flue; the flame then passes along the upper flue to the one below, continuing this zigzag course until the bottom flue is reached, when it passes through ports to the stack flue under the battery of ovens. From here it is led to the stack. This same operation is performed simultaneously at the other end of the oven, there being no reversals of the gas and air. In each port connecting with the stack flue is a damper by which the stack draft for any oven can be regulated. To maintain a uniform temperature in the flues, gas is admitted into the different flues through the burner connections in the front walls, and air can also be admitted through peepholes located near the burner connections. In the roof of the oven are openings for charging coal, and a single opening in the center passes off the gas, evolved during coking, to a gas collecting main on the top of the battery.

The ovens are arranged side by side in a battery of 47. At present there are two of these batteries in operation, and a third is ready for use. The ovens are charged with a compressed cake of coal, with a cross section slightly less than that of the oven and a length a few feet shorter, the cake being delivered to the oven in a charging box. When coked, it is pushed out of the oven by an electric pusher onto a quenching pan, and from there put into cars and taken away. There were 94 Rothberg ovens reported in operation in 1904 and 141 in the process of construction.

USES OF COKE.

While certain minor uses are found for coke, such as an acid-proof distributing medium in chemical works, or as a filtering medium, its most important use is as a fuel and reducing agent, and its greatest consumption is found in metallurgy. It is not a uniform product, but varies with the composition and physical condition of the coal from which it is produced and the manner in which it is made. It may be classified as follows: Metallurgical coke, which includes furnace coke and foundry coke; fuel or domestic coke, which includes egg, stove, and nut coke.

Furnace coke is designed for use in blast furnaces. It should be strong enough to resist the burden of the furnace, not so brittle that it crushes easily in handling in transportation or under the load of the furnace, sufficiently porous to permit the gases to permeate its mass, but so resistant that it may reach the zone of reduction in the furnace without any serious loss from reaction at incandescence with the carbon dioxide rising through the charge. Furnace coke is sometimes spoken of as 48-hour coke.

Foundry coke is used largely in cupola furnaces, and as it must there withstand the weight of the pig iron which is to be melted, it is a denser and stronger coke than that used in blast furnaces. Foundry coke is sometimes spoken of as 72-hour coke. According to Stammler,[1] "Coke for foundry use must be studied from various standpoints. If the cupola is of a low-tuyere type and long heats are taken off, a heavy coke is necessary to furnish sufficient fuel in small bulk to melt the metal and still hold the melting zone in proper position for economical work. Even should a light and strong coke hold the iron without crushing, it might not be possible to get enough of this coke in a low-tuyere cupola to melt the iron and retain the next charge at its proper height. On the other hand, a strong, light coke in a high-tuyere cupola is satisfactory and economical. It takes less coke to hold the iron at the proper melting zone, is more permeable to the blast, burns freer, and melts the iron faster than does heavy coke. Cokes should, therefore, be divided into two classes, and recommended according to their density, for high-tuyere or low-tuyere cupolas, as the coke is light or heavy."

According to Dewey,[2] "The credit of the first systematic investigation of the physical properties of coke belongs to John Fulton, mining engineer of the Cambria Iron Company." This investigation was begun in 1875, and it is now universally admitted that the physical characteristics determine largely the value of a coke. Fulton states [3] that the structure of coke consists of a series of irregular, promiscuously disposed cells, with vitreous walls, these cells being connected by diminutive passages that afford free courses for the oxidizing gases of the blast furnace. It is these hard, vitreous cell walls in coke that give it the superior value it possesses as an energetic fuel in blast furnaces. "From the foregoing it will be evident that the physical structure of coke, other things being equal, is the main element that confers on it the superior place it holds among blast furnace fuels. The same is true, in a modified way, of charcoal fuel. The anthracite holds the lowest rank." Thus the desirable ratio between the cellular space and the cell walls or body in a given volume of the coke has been carefully determined, and it is 43.73 per cent of body to 56.27 per cent of cellular walls. On the other hand, the chemical composition is of importance, as any impurities in the coke may enter the metal which is to be reduced or may form slag, and thus require a certain quantity of flux to prevent a waste of metal. It is well known that coal contains ash, sulphur or sulphur compounds, and phosphorus compounds, and these will be to a certain degree retained by the coke. A coke containing not more than 10 per cent of ash can be regarded as an average clean

[1] Report on Coal Testing Plant, Part III, page 1369.
[2] Trans. Am. Inst. Mining Eng., 1884, vol. 12, page 111.
[3] Coke, by John Fulton, 1905, page 329.

fuel, and those containing only 5 to 7 per cent of ash, as exceptionally pure. The sulphur in coke for use in metallurgical processes should be less than 1 per cent. The best coke contains only 0.5 to 0.75 per cent of this element. The purest varieties of coke contain from 0.012 to 0.029 per cent of phosphorus. Often as much as 40 per cent of the sulphur in the coal is volatilized in the coke oven, but as a rule all the phosphorus in the coal goes into the coke. Often a large part of the sulphur and some of the phosphorus may be removed by washing the coal before coking it. Domestic or fuel coke need not be so free from these foreign bodies and it may be denser and softer. In such a coke readiness in combustibility and, when hot, solubility in carbon dioxide gas are desirable, as, for instance, in producers when coke is used for making gas.

Besides being used in gas producers and water gas generators, coke is being largely used as a fuel for locomotives, especially in New England. It is also being crushed to size, screened and bagged for use as domestic fuel. According to the United Coke and Gas Company,[1] "Of the large output of the New England Gas and Coke Company, at Everett, Mass., some 200,000 gross tons per year are disposed of for domestic and industrial service, a similar amount being used for firing locomotives, particularly in suburban service, because of its smokeless nature. The same outlet has been found for the output of the Camden plant, a portion of which, however, is sold for foundry purposes." The fine coke, or braize, made in the handling and crushing of the coke is used directly under steam boilers, or it is made up into briquettes, although some is employed in lining steel furnaces. The amount and value of the coke consumed in each branch of the iron and steel industry, together with the per cent which this quantity forms of the total output, are given in Table 19 for each census year from 1880 to 1905.

[1] Short Treatise on the Destructive Distillation of Bituminous Coal, 1906, page 101.

TABLE 19.—QUANTITY AND COST OF COKE CONSUMED IN THE IRON AND STEEL INDUSTRY: 1880 TO 1905.

BRANCH OF INDUSTRY.	QUANTITY IN SHORT TONS.				COST.				PER CENT OF TOTAL PRODUCT.			
	1905	1900	1890	1880	1905	1900	1890	1880	1905	1900	1890	1880
All branches	20,378,452	17,682,072	9,797,353	2,315,560	$59,136,419	$40,991,400	$28,752,972	$8,743,382	81.0	90.0	97.9	84.1
Blast furnaces	19,739,676	16,755,489	9,402,898	2,166,260	57,127,027	38,976,770	27,435,780	8,129,240	78.5	85.3	94.0	78.7
Rolling mills and steel works	638,776	926,516	393,051	142,605	2,009,392	2,014,390	1,311,588	582,901	2.5	4.7	3.9	5.2
Forges and bloomeries	....	67	1,404	6,695	....	240	5,604	31,241	....	(1)	(1)	0.2

[1] Less than one-tenth of 1 per cent.

From a table of statistics given by J. M. Swank,[1] showing the extent to which different fuels have been used in the United States for iron smelting, it appears that prior to 1855 charcoal was supreme, the quantity used exceeding that of either anthracite coal or coke, but in that year the consumption of anthracite exceeded that of charcoal; in 1869 the consumption of coke exceeded that of charcoal; in 1875 the consumption exceeded that of either charcoal or anthracite coal; in 1880 the consumption of coke exceeded that of both charcoal and anthracite combined, and this supremacy of coke has been maintained and extended ever since.

The account for the consumption of coke in the United States in the census year may be thus set forth:

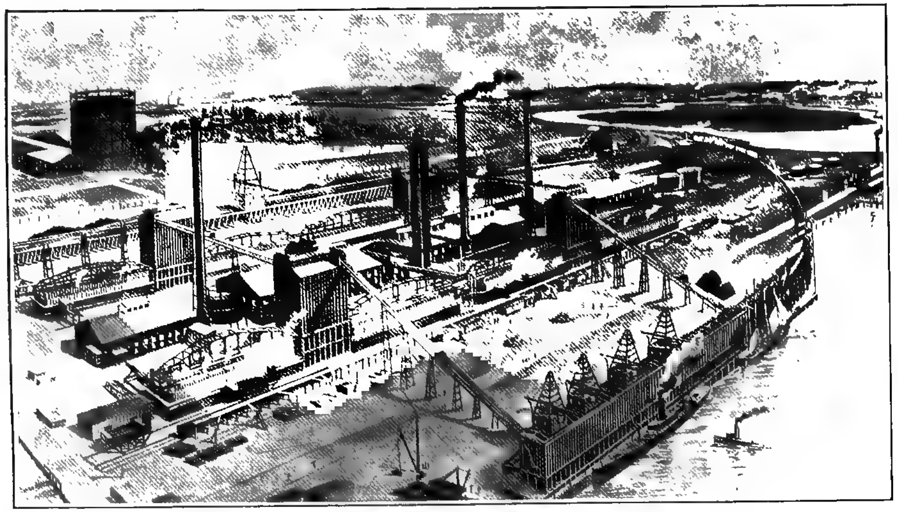
	Short tons.
Total	25,362,817
Coke produced	25,143,288
Coke imported	219,529
Total	25,362,817
Coke used in iron and steel industry	20,378,452
Coke exported	616,273
Coke used for all other purposes	4,368,092

USES OF BY-PRODUCTS.

The ammoniacal liquor coming from the washers contains from 0.5 to 2 per cent of ammonia existing in a variety of compounds. It is so weak it must be further treated before it is marketable. On subjecting it to heat, part of this ammonia, known as free ammonia, comes off and may be collected in water. The rest may be liberated by heating the liquor with lime or some other alkali. The treatment then consists in distilling the liquor with lime and either collecting the distillate in sulphuric acid so as to form ammonium sulphate, or else condensing it with sufficient steam to form a strong liquor containing from 15 to 20 per cent of ammonia. The ammoniacal liquor from by-product coke ovens, gas works, boneblack factories, and blast furnaces is the chief source of the ammonia water, anhydrous ammonia used in refrigeration, and the ammonium compounds of commerce. Ammonium sulphate is used in the manufacture of alum and other compounds and as an ingredient of fertilizers. The quantity of ammonium sulphate reported as used in the present census year in fertilizers was 21,080,000 pounds. The total product of ammonium sulphate reported for that year was 31,546,763 pounds, and the amount imported 30,576,558 pounds, or a total of 62,123,321 pounds, so that but slightly over one-third of the available supply was consumed in the manufacture of fertilizers.

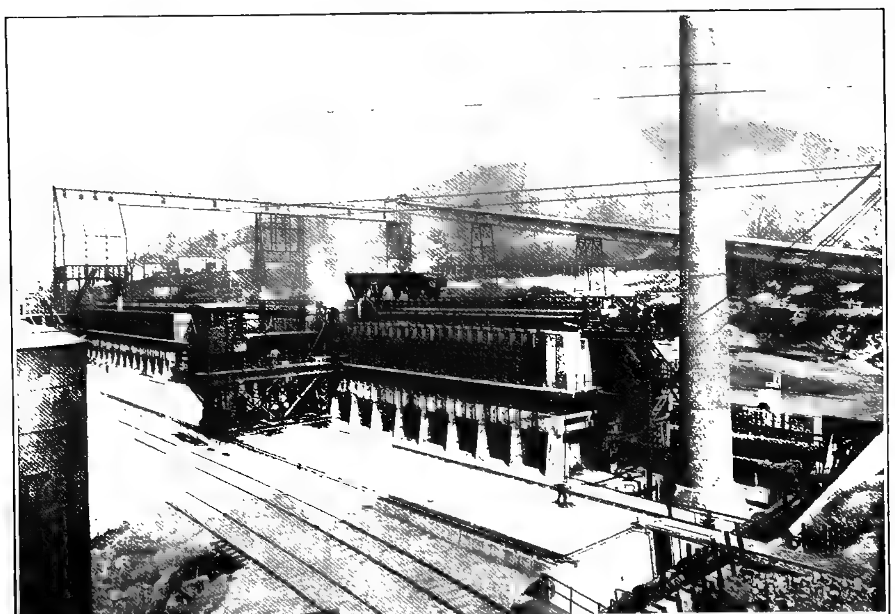
[1] Manufacture of Iron in All Ages, page 284.

The tar which results from the dry distillation of coal

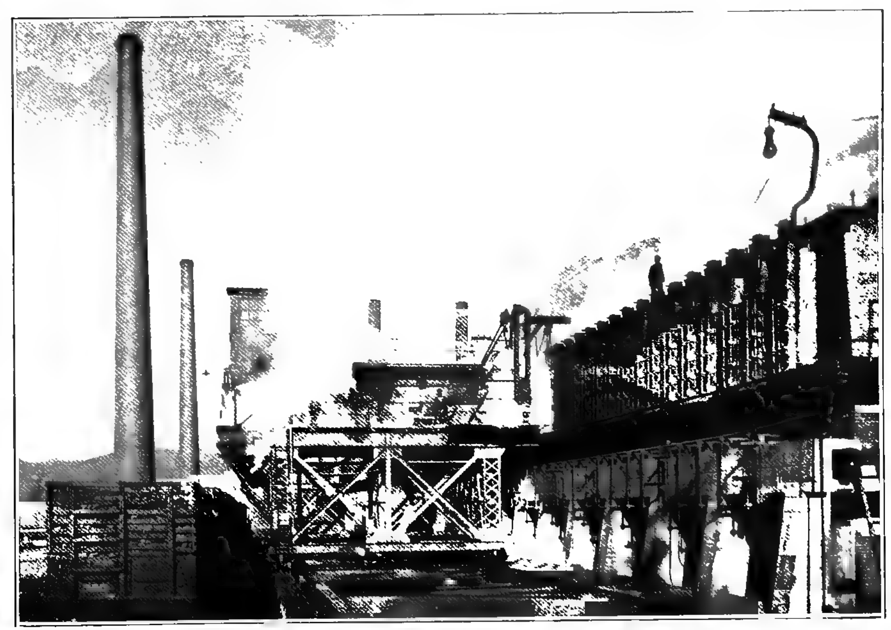


GENERAL VIEW OF PLANT AT EVERETT, MASSACHUSETTS.

SECTIONAL VIEW OF CONDENSING APPARATUS.



LATEST INSTALLATION OF 100 OVENS OF STEEL PLANT AT JOHNSTOWN, PENNSYLVANIA.



QUENCHER IN OPERATION.

is a mixture of a variety of hydrocarbons, amines, phenols, and other organic substances together with free carbon, and it varies both with the character of the coal treated and the manner in which it is treated. By-product coal tar differs from gas-house coal tar in that it contains only about 14 per cent of free carbon, while gas-house tar contains as much as 28 per cent. This is due to the much higher temperature of the gas retort, the greater rapidity with which the maximum temperature is attained, and the smaller charge used. The percentage of tar acids is also greater in gas-house tar than in coke-oven tar. The tar acids from coke-oven tar contain a high percentage of cresol, thus necessitating many distillations in order to produce pure phenol. Coal tar is the source of many organic substances, such as artificial dyestuffs and photographic and pharmaceutical chemicals. In the crude state it is used in making tarred paper, paint, and varnishes for coating bricks; and as a fuel, being equal, weight for weight, to crude petroleum in fuel value. Five pounds of tar are practically equal to from 7 to 8 pounds of coal. When heated to 250° C., to drive off the volatiles, coal tar pitch is produced, which is used in making tar macadam pavements, about 2 gallons being used per square yard of finished road. According to Pennock,[1] "As a consumer of tar, the tar macadam for 1903 will absorb 4,000,000 gallons, or the product of the dry distillation of 400,000 tons of coal." The tar macadam laid in the United States in 1901 by a single company was 14,400 square yards; in 1902, 440,000 square yards; laid and contracted for in 1903, 2,001,000 square yards, so that this industry is a constantly growing one. Coal tar pitch is also used for briquetting. In distilling the tar to obtain the pitch the distillate is divided into two portions—that which is lighter than water and that which is heavier. The light oil is redistilled for benzol and solvent naphtha. The heavy oil is in demand for creosoting timber. Two grades of pitch are usually made—paving pitch and roofing pitch.

[1] Loc. cit., page 788.

The volume of gas evolved from a by-product oven is determined directly by the quantity of volatiles in the coal used and the heat applied. The quantity necessary to be returned to heat the ovens varies also with the coal. If the coal contains 32 to 34 per cent of volatile matter, from 50 to 55 per cent of the gas must be returned, but less gas suffices for those containing less volatile matter. The composition of the gas varies throughout the operation, it being richer in illuminants, methane, and carbon monoxide at the beginning. In separating the gas, in order to sell the surplus, the first runnings from 22 down to 14 candlepower are taken. This comes off on an average in the first ten hours of the operation. The rest of the gas, known as the lean gas, is that which is used in heating the coke ovens. Sometimes the benzol is removed from this lean gas and added to the surplus gas to enrich it—that is, to increase its candlepower. The benzol is removed by scrubbing the gas with tar oil, which dissolves it, and then recovering the hydrocarbon from the tar oil by fractional distillation. Gas from by-product plants is sent considerable distances. The plant at Everett, Mass., supplies Boston and the surrounding cities; from Sparrow Point, Md., the gas is pumped 11 miles to Baltimore; from the Camden, N. J., plant it is pumped 38 miles to Trenton; and the Duluth plant supplies the cities of Duluth and Superior.

APPENDIX A.

BIBLIOGRAPHY.

ATWATER, CHRISTOPHER G. *The Development of the Modern By-product Oven*, Transactions American Institute Mining Engineers, 1903, vol. 33, page 760.

BLAUVELT, W. H. *The By-product Coke Oven*, Journal Western Society of Engineers, August, 1905, vol. 10, pages 477–499.

BJÖRLING, PHILIP R. *Briquettes and Patent Fuel.* London, 1903.

CATLETT, CHARLES. *Coking in Beehive Ovens with Reference to Yields*, Transactions American Institute Mining Engineers, 1903, vol. 33, page 272.

DEWEY, FRED P. *Porosity and Specific Gravity of Coke*, Transactions American Institute Mining Engineers, 1884, vol. 12, page 111.

DOW, ALLAN W. *Coal Tar Pavements*, Municipal Journal and Engineer, March, 1903, No. 3, vol. 14.

FULTON, JOHN. *A Treatise on the Manufacture of Coke and Other Prepared Fuels and the Saving of the By-products*, 2d edition. Scranton, Pa., 1905.

PENNOCK, JOHN D. *The Retort Coke Oven and the Chemistry of its By-products*, Journal American Chemical Society, 1899, vol. 21, pages 678–705.

——— *By-product Coke Industry of the United States*, Berichte V. Internationaler Kongress für Angewandte Chemie, vol. 2, pages 776–797. Berlin, 1904.

PRATT, JOSEPH HYDE. *Briquetting Tests.* Report on the Coal Testing Plant at Louisiana Purchase Exposition, Professional Paper No. 48, United States Geological Survey, Part III, page 1389. Washington, 1906.

SCHNIEWIND, F. *The Everett Coke Oven Plant*, Progressive Age, 1899, vol. 17, pages 366–370, 386–392.

VON SCHRENK, HERMANN. *The Decay of Timber and Methods of Preventing it*, Bureau of Plant Industry, Bulletin No. 14, United States Department of Agriculture. Washington, 1902.

STAMMLER, FRED W. *Coking Tests.* Report on the Coal Testing Plant at Louisiana Purchase Exposition, Professional Paper No. 48, United States Geological Survey, Part III, page 1326. Washington, 1906.

SWANK, JAMES M. *History of the Manufacture of Iron in All Ages.* Philadelphia, 1884.

UNITED OTTO-COKE AND GAS COMPANY. *A Short Treatise on the Destructive Distillation of Bituminous Coal, with Reference to the United-Otto System of By-product Coke Ovens.* New York, 1906.

WEEKS, JOS. D. *Report on the Manufacture of Coke.* Tenth Census of the United States, Vol. X.

APPENDIX B.

DIGEST[1] OF PATENTS RELATING TO COKE.

This digest covers the patents included in the subclasses named in Class 202, Charcoal and Coke, of the United States Patent Office classification.

Some of the patents in these categories are quite foreign to the subject under consideration and many but indirectly related to it. On account of the form which discussions of patent issues often take, it has been thought better, however, to include these latter patents. The aim in making the digest has been to give such a sketch as will indicate the nature of the invention and what is claimed by the inventor, this generally being done by an actual abstract from or paraphrase of the words of the letters patent, but no responsibility is assumed for the opinions, theories, or claims thus set forth. Other related patents may have been granted which do not appear in this digest, because they are not embraced in the subclasses enumerated. It is suggested that such patents may be found in the classes relating to illuminating gas, wood distillation, and similar topics.

CLASS 202.—CHARCOAL AND COKE.

CHARCOAL.

SUBCLASS 2.—PROCESSES.

720—April 28, 1838. MICHAEL CARROLL. *Improved mode of forming a kiln for making charcoal.*

Relates to the manner in which the logs are to be piled in forming the mound.

14,619—April 8, 1856. SANDFORD S. PERRY. *Improvement in charring wood.*

Claims the process or mode of charring wood, or, as it is commonly called, "burning charcoal," by the application of hot or heated air to the wood to be charred.

16,304—December 23, 1856. ANDREW GRIMES. *Improvement in burning charcoal.*

Claims burning wood in the open air without any covering of earth, or any substitute therefor, in such a manner as to reduce any given amount of wood to a mass of red-hot coals while preventing the pile from burning to ashes until this result is accomplished.

129,815—July 23, 1872. LEVEN S. GOODRICH. *Improvement in processes and apparatus for the manufacture of charcoal.*

Claims the process which consists of a variable air supply to carry on the process of wood charring by the combustion of the flammable gaseous products thereof, and to prevent the said air supply from coming in direct contact with the charcoal produced by the distillation of the wood by the said combustion.

196,714—October 30, 1877. LEVI STEVENS. *Improvement in coking coal and desulphurizing the coke.*

Claims the process of coking coal, which consists in passing the gases evolved from the coking coal contained in one chamber into and through the coke contained in an adjoining chamber, produced from a previous charge, and kept at a high temperature, whereby said coke takes up carbon from the hydrocarbon gases of the coking coal, and is thereby rendered compact and firm.

200,862—February 26, 1878. WILLIAM A. MILES. *Improvement in methods of operating charcoal kilns.*

Claims the method of operating charcoal kilns consisting, essentially, in first, preparing the kiln in the usual well-known manner and lighting the fire; second, closing tightly the usual opening or openings into the atmosphere; and, third, forcing air into the kiln in a series of equal or unequal jets and out of the same with the products of distillation in another series of jets to the condenser.

211,376—January 14, 1879. HORACE L. BROOKE. *Improvement in plants and processes for the manufacture of charcoal and pyroligneous acid.*

Claims the process of manufacturing charcoal and pyroligneous acid, consisting in forcing into a charcoal kiln a quantity of air sufficient to support combustion of a part of its contents, and thereby char the rest, and condensing and recovering the pyroligneous acid and vapors.

249,366—November 8, 1881. JOSHUA KIDD. *Charring oven.*

Claims the improvement in the method of charring substances which consists in passing the products of combustion through a fresh charge of material for charring the latter and depriving the products of combustion of a large proportion of their heat, and then passing the same in their lowered temperature through a charge of material which has been previously charred for expediting the cooling thereof.

272,976—February 27, 1883. HENRY M. PIERCE. *Process of manufacturing charcoal.*

Claims in the manufacture of charcoal, the method of conducting the carbonizing process, which consists in admitting the air supply at or near the center and base of the charge, firing the charge at or near the top thereof, and withdrawing the gases and vapors from the base and circumference of the charge.

278,731—June 5, 1883. HENRY M. PIERCE. *Manufacture of charcoal.*

Claims as an improvement in the manufacture of charcoal or coke the method for cooling the contents of the kiln, consisting in maintaining a circulation through the kiln of a noncombining gas—such as carbonic oxide or carbonic acid, said gas being maintained at a lower temperature than the kiln and its circulation continued after the fire has been extinguished and until the contents of the kiln have been reduced to a low temperature; and,

The method of extinguishing the fire of a charcoal kiln or like chamber and cooling the charge thereof, which consists in cooling the carbonic acid gas generated from the burning or carbonizing mass contained in the kiln and then forcing it into the kiln and into and among the charge.

284,058—August 28, 1883. HENRY M. PIERCE. *Method of distilling and charring wood and kiln therefor.*

Claims the method of distilling and charring wood, which consists in firing the charge and withdrawing the moist volatile products from the top of the charge, and condensing liquefiable portions, then closing the discharge pipe at the top of the kiln and withdrawing the gases down through the charge to the bottom of the kiln, condensing the liquefiable portions thereof, and forcing the uncondensed gases by a steam-jet ejector to a furnace for combustion.

284,059—August 28, 1883. HENRY M. PIERCE. *Process of manufacturing charcoal and kiln therefor.*

Claims the method of manufacturing charcoal, which consists in charging the kiln with wood laid in reticulated form and with flues extending from bottom to top of the kiln, firing the charge, and admitting jets of steam or other gaseous fluid into the flues, and thereby causing a circulation of the heat and gaseous products through all the interstices of the charge, whereby it is rapidly and uniformly heated and reduced to charcoal of even quality.

309,874—December 30, 1884. HENRY M. PIERCE. *Method of and apparatus for treating wood for the manufacture of charcoal.*

Claims the method of preparing woods for carbonization, which consists in permitting the condensable vapors of an initial charge to escape directly into the open air, or into a condenser, and then passing the light, highly heated gases given off toward the close of carbonization or distillation through the fresh charge to be treated.

326,452—September 15, 1885. HENRY M. PIERCE. *Process of utilizing wood gases for metallurgical purposes.*

Claims in a blast furnace the process of utilizing the gases evolved in the destructive distillation of wood as fuel, which consists in first conducting the wood gases to a condenser and reducing to liquid their condensable constituents, then forcing the uncondensable gases into a heating chamber which is heated by the waste gases from the said blast furnace, then mixing a suitable quantity of atmospheric air with said wood gases, and then injecting the whole into a blast furnace.

345,131—July 6, 1886. LEVEN S. GOODRICH. *Process of manufacturing charcoal.*

Claims in charcoal making, the process which consists in arresting and storing the noninflammable gases resulting from the carbonizing process, and at the completion of the latter returning said gases to the kiln under pressure greater than that of the external atmosphere, and maintaining such pressure within the kiln until the cooling of the latter is effected.

[1] Copies of these patents may be obtained upon application to the United States Commissioner of Patents, Washington, D. C., at a cost of 5 cents each.

486,265—December 29, 1891. LEOPOLD ZWILLINGER. *Process of and apparatus for making charcoal.*

Claims in the manufacture of charcoal, the improvement which consists in placing the material in a retort, and means substantially such as described for heating the same, applying heat to the latter, and passing through the material in the retort superheated air substantially free from oxygen and combined with steam by first passing the air through water for the purpose of eliminating the oxygen and combining the air with moisture, and then superheating the moisture laden air.

477,875—June 28, 1892. ALBERT VICKERS. *Method of arresting and extinguishing combustion in charcoal kilns.*

Claims the method of arresting and extinguishing combustion in charcoal kilns, which consists in introducing into the kiln, after firing has reached the desired point, sulphuric acid or like liquid decomposable into noncombustible gases under the action of the heat and carbon present and causing the said generated gases to circulate continuously through the charcoal from top to bottom of the kiln.

607,331—July 12, 1898. JOSEPH BERRY. *Charcoal kiln.*

Claims a charcoal kiln consisting of a foundation of longitudinally laid sticks, a V-shaped space formed by the arrangement of sticks at the front portion of the kiln, a series of draft spaces formed around the edge of the kiln by overlapping the ends thereof, and a superstructure composed of cord wood built thereon.

705,213—July 22, 1902. OSCAR DAUBE. *Method of carbonizing organic materials.*

Claims the method of carbonizing organic material and material of organic origin which consists in mixing 66⅔ per cent air under a constant pressure of from 5 to 8 pounds and 33⅓ per cent highly nitrogenous gas: passing the resultant gas through a coal fire, reducing the temperature of the gas issuing from the fire to from 400° to 600° Fahrenheit, subjecting the material to be carbonized to said last mentioned gas at the said temperature of from 400° to 600° Fahrenheit, and under the said pressure still constantly maintained, and exhausting the gases emanating from said material during carbonization immediately they free themselves.

705,926—July 29, 1902 JOSEPH HEMINGWAY. *Continuous process of coking coal.*

Claims the continuous process of making metallurgical coke which consists in pulverizing bituminous or semibituminous coal, mixing it with about 4 per cent of boiling hot water, mixing the moistened mass with about 10 per cent of coal tar, charging the coking ovens with said mixture, distilling it, and returning the heavy portion of the distillate, containing tar, pitch, and similar substances (mixed with a fresh charge of coal moistened with hot water) into the coking ovens during the coking operation.

711,905—October 21, 1902. THADDEUS S. C. LOWE. *Process of manufacturing coke.*

Claims in the manufacture of coke the process of continuously and progressively converting the charge into coke and intermittently recovering gas from the charge while being coked, which consists in alternately raising the temperature of the oven arches to above the temperature required for coking, and then introducing steam at or above its decomposable temperature into the upper parts of the ovens and above the body of the charge with reference to effecting the recombination of the elements of the steam and the otherwise waste gas evolved in coking into a fixed recoverable gas.

744,669—November 17, 1903. BERNHARD ZWILLINGER. *Process of carbonizing and cooling down the charge.*

Claims the process of producing carbonized substances which consists in initially carbonizing the said substances and subsequently, while the charge is still hot, continuously subjecting it to the action of mechanically propelled cooled gases free of uncombined oxygen in a greater quantity than the capacity of the carbonized substances for absorption after cooling and at atmospheric pressure, whereby the charge may be cooled down in a rapid and efficient manner.

744,670—November 17, 1903. BERNHARD ZWILLINGER. *Process of carbonizing material.*

Claims the process of carbonization which consists in preliminarily deoxygenizing atmospheric air, heating the resultant gas to such a temperature as to effect the carbonization of the carbonizable material in the kiln at a temperature not exceeding 800° Fahrenheit, and acting upon the said material with the said heated gas, removing the products of carbonization, and thereupon continuing the carbonization by heating and circulating the said products of carbonization through the kiln so as to effect the carbonization at a temperature not exceeding 800° Fahrenheit.

794,481—July 11, 1905. DAVID M. BALCH. *Process of manufacturing fuel from seaweeds.*

Claims the process of treating seaweed to obtain fuel consisting in drying the weed, then coating the weed with an alkaline substance prior to further treatment, then subjecting the dried and alkaline-coated weed to the indirect action of dry heat immediately subsequent to coating the weed with the alkaline and until the volatile products are driven off and a char results, then lixiviating the charred residuum with water until the saline constituents of the residuum are removed, and subsequently drying the residuum.

SUBCLASS 3.—RETORTS.

8,492—November 4, 1851. W. P. McCONNELL. *Improvement in the manufacture of charcoal.*

Claims an iron cylinder with a double bottom, the upper one being perforated, and these combined with several flues covered at the top with dampers and protected within with iron rings, the whole so constructed that the fire may be applied either on the top, under the bottom, or within the flues, or in all together, at pleasure.

96,649—November 9, 1869. JOHN ADAMS. *Improved apparatus for carbonizing peat.*

The invention consists in carbonizing peat for making into marking ink and other useful products, by heating the peat in retorts set in a furnace and connected with a steam boiler, so that when carbonization is attained the fire may be extinguished by the steam.

184,963—December 5, 1876. GEORGE L. HARRISON, JR. *Improvement in processes and apparatus for the manufacture of charbon-roux.*

Claims the process of making charbon-roux which consists in subjecting billets of wood to heat under agitation, and the combination of a retort having a removable head plate, and pipe, with a revolving cage and furnace.

197,942—December 11, 1877. MOSES NICHOLS. *Improvement in retorts for making gunpowder charcoal.*

The object of this invention is to provide a retort and furnace for making charcoal for the manufacture of gunpowder and for the distillation of pyroligneous acids for medicinal and chemical purposes of more uniform quality than has hitherto been produced from retorts as ordinarily constructed, owing to the uneven application of the heat from the furnace, whereby the outer portions of the contents of the retort are generally burned too much, while the interior is not sufficiently burned, resulting in a loss of wood and a variable quality of charcoal unfit for the particular purpose designed; and it consists in a novel arrangement of flues and diaphragms both around and within the retort; also in provision for extracting and preserving the acids evolved during the process of burning.

276,222—April 24, 1883. JOHN BURT. *Charcoal furnace.*

Claims in an oblong charcoal furnace the combination of a removable heating chamber arranged in said furnace, forming retort chambers, the floors of which overhang the front and rear of the fire chamber and incline from the centrally located heating chamber to the front and rear to form the top of the front and rear ends of the fire chamber.

283,643—August 21, 1883. CHARLES S. NELLIS. *Charcoal kiln.*

Claims the combination of the retorts having a combustion chamber extending through it, horizontal flues communicating at each end with the chimney and connected with the combustion chambers, respectively, at the upper and lower end of the retorts, vertical flues connecting the horizontal flues intermediately between the retorts, and dampers in the horizontal flues intermediately between the vertical flues and combustion chambers at each side thereof.

387,817—August 14, 1888. JACOB SCHERFFIUS. *Apparatus for the manufacture of charcoal.*

Claims in an apparatus for producing charcoal, the combination, with a fire chamber, of a charring chamber, a jacket surrounding said charring chamber, a space, however, being left between the walls of the charring chamber and the walls of the jacket, tubes or pipes connecting the outlet of the fire chamber with the space between the walls of the charring chamber and its jacket, valves or dampers arranged in connection with said tubes, a smoke pipe leading from said space between the charring chamber and its jacket, and a branch smoke pipe provided with a damper, which said branch smoke pipe leads from the discharge opening of the fire chamber to the main smoke pipe.

407,166—July 16, 1889. FRANKLIN S. CLARK. *Retort for distilling wood and making charcoal.*

Claims in a wood-distilling apparatus, a furnace, combined with the stationary outer cylinder, arranged within the furnace, and a removable inner cylinder to contain the wood and having openings in its sides, said inner cylinder being smaller than the outer cylinder and arranged within the latter, so as to provide an air space around the inner cylinder, with which air space the openings communicate, and doors on the inner cylinder for closing the openings, said doors being carried by the inner removable cylinder when it is drawn out.

409,873—August 27, 1889. JACOB SCHERFFIUS. *Charcoal apparatus.*

Claims the combination, with fire and charring chambers, of a dampered pipe extending from the former into the latter, chambers surrounding both the fire and charring chambers, communication being established between the fire chamber and the chamber surrounding the charring chamber and between the latter and the chamber surrounding the fire chamber, and condensing pipes connecting the charring chamber and the chamber surrounding the fire chamber.

682,313—September 10, 1901. BERNHARD ZWILLINGER. *Apparatus for carbonizing material.*

Claims the combination, with a carbonizing chamber, having its lateral walls made hollow to form a flue extending nearly around the chamber, of a chimney leading from one end of said flue, and a superheating furnace discharging its waste gases into the opposite end of said flue, whereby the chamber is practically surrounded by a constantly renewed layer of heated gas, and means for passing gas through said superheating furnace and into the carbonizing chamber.

687,304—November 26, 1901. GUSTAF GRÖNDAL. *Apparatus for charring wood, etc.*

Claims the process of continuously carbonizing or charring wood and the like, consisting of passing the wood through a furnace, causing a gas indifferent to red-hot coals to enter the furnace at a point where the coals are incandescent, thereby heating the gas and cooling the coals, passing said heated gas around a charring muffle, but not in contact with the wood therein, admitting air to the gas at this point to cause combustion to char the wood in the muffle, and causing the burned air and gas to heat the wood preliminary to its reception into the muffle.

701,145—May 27, 1902. CHARLES J. T. BURCEY. *Apparatus for manufacturing charcoal.*

Claims an apparatus for manufacturing charcoal comprising a combustion chamber, a receiving chamber for the wood to be charred, a main heat conducting passage communicating with the combustion chamber, a plurality of passages communicating independently with the main heat conducting passage and also communicating independently with the atmosphere, said passages being each provided with an inclosing wall for preventing the escape of the products of combustion from the passages into the interior of the receiving chamber, and means for controlling the flow of the products of combustion from the combustion chamber and the main heat conducting passage to the atmosphere through said plurality of passages independently, and thereby rendering substantially uniform the treatment of the wood in the different portions of the interior of the receiving chamber.

731,059—June 16, 1903. PER LORENTZ LAURELL. *Retort for carbonizing wood or the like.*

Claims a carbonizer comprising a retort having a central open-ended flue, a casing, a source of heat supply on one side and at the foot thereof, a support for the retort in said casing inclining downwardly to the opposite side, flues below said support provided with cut-off devices and diverging from the source of heat supply and leading to a central space in communication with the flue of the retort, an air flue opposite the source of heat supply, provided with a cut-off device and leading also to said central space, a pipe provided with a vertical branch in said air flue and connected with the retort at its lowest point, and a stack in communication with the space about the retort substantially at the lowest point of its support.

744,700—November 17, 1903. ALONZO T. WILSON. *Charcoal or coke oven.*

Claims an oven for making charcoal and coke comprising a front wall having a doorway, a rear wall having horizontal flues, a chimney connected with said flues, an arched wall and roof closed from top to bottom and from front to rear, a closed floor, furnaces in the front wall under the floor and communicating with an open space under the floor and combustion chamber extending rearward from the front wall and upward from the furnaces and provided with apertures communicating with the chamber above the floor.

777,415—December 13, 1904. WERTHER ANDERS GUSTAF VON HEIDENSTAM. *Apparatus for charring wood refuse or the like.*

Claims the combination, with a charring retort for wood refuse, peat, or the like, of a plunger, guide rods provided with a bottom plate and guide plates adapted to divide the material into sections while being charred, and a hood inclosing said guide rods, guide plates, and charring material.

796,103—August 1, 1905. JOHAN EMANUEL ÅSLIN. *Charring retort.*

Claims in a charring kiln a substantially cylindrical retort having a pair of separate furnaces at the front, a flue leading from each furnace through the outer walls of the retort to the rear portion of the furnace, upwardly extending passages communicating with the rear portions of said flues, a valve in each said flue adjacent its rear extremity, a flue extending across the bottom of the retort and leading from each said furnace and opening into the rear portion of each said flue, a valve arranged at the portion of each said latter flue adjacent the furnace, and a valve arranged at the other extremity of each said latter flue.

804,239—November 14, 1905. THEODOR LEDERMÜLLER. *Apparatus for carbonizing peat.*

Claims in an apparatus for carbonizing peat, the combination, with a heating oven, of a press adapted to contain the peat and mounted in the oven in a position to be exposed to the gases from the fireplace of the oven, a series of press plates arranged in said press and adapted to receive molding boxes between them and means permitting the introduction of molding boxes between said press plates without their traversing the fireplace of the oven.

SUBCLASS 10.—KILNS.

5,722—August 22, 1848. A. H. TAIT. *Improvement in coking wood by the waste heat of iron furnaces.*

Claims the application of waste or escape heat from forge or furnace fires making iron to the purpose of coking wood by radiation from flues constructed of iron or any other suitable material and in the same process of coking by waste or escape heat to extract from the wood pyroligneous acid, the flues being so arranged in connection with walls or piers as to prevent the wood from coming in contact with or resting upon said flues or pipes, by which means the atmospheric air is excluded and that portion of the wood consumed by the old process in coking the remainder converted into charcoal.

36,090—August 5, 1862. CHARLES T. HARVEY. *Improvement in charcoal kilns.*

The object of this invention is to combine a kiln for the manufacture of charcoal, so as to secure portability, exclusion of air, strength, and durability in a novel and useful manner. To do this, construct an outer shell or covering of convenient form and size, of metal divided into convenient segments, sections, or parts, composed of one or more sheets of metal and prepared with bolts or other fastenings, so that when each segment or part is placed in position it can be securely fastened to and with other segments or parts, so as to form, collectively, a complete metallic kiln, covering, or outer shell strong and durable. Then lay upon the inside a thin wall of brick or stone, having a space left between it and the metallic covering. Then fill in the space between the masonry lining and metallic covering with cement or grout formed of fire clay or other fluid mortar hardening in due time, which, when accomplished, renders the kiln complete and ready for use.

56,528—July 24, 1866. K. S. CHAFFEE. *Improved apparatus for making charcoal.*

This invention relates to a charcoal kiln provided with means for condensing pyroligneous acid from the smoke and volatile products resulting from a charge when in combustion within such kiln instead of being heated from outside, and the inventor—

Claims the application of a condenser to a kiln by extending such condenser as a pipe around the kiln and supporting it by means of series of branch pipes leading from it into the kiln, and combining with such condenser a discharge pipe to extend from it.

71,383—November 26, 1867. WILLIAM H. GUIGNON AND WILLIAM D. McDONALD. *Improvement in kilns for charring wood, etc.*

Claims a kiln for charring or carbonizing wood or coal, which is self-acting or automatic in its operation, and a portable kiln for carbonizing wood or coal, which is formed of a double wall, or an outer and an inner shell, whereby the heat is confined in the kiln.

78,264—May 26, 1868. MORTON E. CONVERSE AND ABEL T. ATHERTON. *Improvement in the manufacture of pyroligneous acid.*

Claims the application and arrangement of the flue tubes in one or more rows, to a kiln in such a manner that they will conduct, carry off, and save, the products of destructive distillation of wood.

129,814—July 23, 1872. LEVEN S. GOODRICH. *Improvement in apparatus for the manufacture of charcoal.*

The object of this invention is to produce an apparatus for the manufacture of charcoal which will save all the useful products arising from the distillation of the wood and at the same time increase the quantity and improve the quality of charcoal produced from any given amount of wood, and it consists in constructing a stationary kiln or furnace of any suitable size to contain about one-half of the wood to make a desired charge, covering the said kiln with a telescopic bottomless holder, which reciprocates vertically in an annular chamber surrounding said kiln, provided with a suitable liquid for sealing the same, like that of an ordinary gas holder. Said holder rises high enough to form a chamber between its top and the bottom of the kiln of sufficient dimensions to receive an amount of wood to make the desired charge, thus making up for the deficient capacity of the kiln itself, which is only designed to hold about half of said charge. At or near the top of said holder is situated a suitable number of doors, through which the kiln may be charged to avoid the necessity of removing the said holder for that purpose. Near these doors is situated a pipe or pipes for carrying off the products of distillation. The bottom of the kiln is provided with an arch, to which access may be had for regulating the air supply, which enters the kiln through orifices in said arch.

163,700—May 25, 1875. WARREN SPARROW. *Improvement in charcoal kilns.*

Claims a sectional charcoal kiln for the dry distillation of wood, composed entirely of thin metal sheets, which are formed into sections and adapted to be placed on and combined with a perforated foundation of stone.

178,855—June 20, 1876. BART KANE. *Improvement in charcoal kilns.*

Claims a kiln for making charcoal. of conical shape, with air-tight top, doors at base and midway up, and holes around its base.

225,297—March 9, 1880. WILLIAM A. MILES. *Charcoal kiln.* (*Reissue 10,746, July 20, 1886.*)

This invention covers a by-product kiln in which the gases generated are recovered and used in the further carbonization of the wood under treatment.

243,301—June 21, 1881. HENRY M. PIERCE. *Manufacture of charcoal.*

The invention relates to the utilization of the noncondensable and uncondensed gases and vapors given off in the carbonization of wood for the purpose of charring the wood, and has for its object to economize fuel and obtain a larger yield of charcoal from the kiln; and,

Claims the combination, with a closed charcoal kiln, of a weighted or automatic vent valve or valves, a valved eduction pipe, an induction pipe, and an interposed fan.

243,302—June 21, 1881. HENRY M. PIERCE. *Automatic cooler for kilns.*

This invention has for its object to save time and labor, to increase the working capacity of the apparatus employed, and consequently to reduce the capital required for various manufacturing purposes, such as the manufacture of charcoal, lime, and the like, or wherever the contents of kilns, furnaces, and heating chambers are preferably or necessarily cooled out of contact with the air; and,

Claims the combination, with a kiln, furnace, or heating chamber, of an eduction pipe leading from, at, or near the upper part of the kiln, a cooler located above the level of the kiln or furnace, and an induction pipe leading from the cooler to the kiln, whereby an automatic circulation of a cooling gas through the kiln or furnace can be established and maintained.

266,850—October 31, 1882. WALTER A. LOVELACE. *Charcoal kiln.*

This invention relates to that class of charcoal kilns in which the kiln consists of a hood adapted to be seated upon a foundation and provided with a door and with smoke and steam escape pipes; and,

Claims the combination of a kiln hood with its foundation provided with an inclosed centrally located fireplace, hot-air flues for conducting the hot air from the fireplace into the kiln, and smoke and steam escape flues for conducting smoke and steam through the foundation from the kiln to the external atmosphere when the hood is closed.

272,766—February 20, 1883. HENRY M. PIERCE. *Charcoal kiln.*

Claims a charcoal kiln having one or more transverse pendent partitions which divide the upper portion of the kiln into a series of separate chambers and having its floor made up of inclines whose lowest points are beneath the transverse pendent partitions.

292,635—January 29, 1884. JOHN A. EDWARDS. *Charcoal oven.*

Claims a conical metallic charcoal oven adapted to rest on the ground, in combination with corner posts and hoisting ropes.

307,928—November 11, 1884. JOHN A. EDWARDS. *Charcoal oven.*

Claims a charcoal furnace composed of sheets of metal, the sheets of the upper course being lapped outside the edges of the lower, whereby the joint is made automatically air tight in use.

326,451—September 15, 1885. HENRY M. PIERCE. *Apparatus for utilizing wood gases.*

The object of this invention is to provide means, in combination with a blast furnace, whereby the gases evolved in the destructive distillation of wood, together with some fixed fuel—such as charcoal, coke, or coal—may be utilized for the reduction of ores; and,

Claims, in an apparatus for utilizing wood gases for metallurgical purposes, the combination of a charcoal kiln, pipes leading therefrom, a heating chamber through which said pipes pass, a blast furnace to which said pipes lead, and a second pipe leading from the blast furnace to the heating chamber, whereby the spent gases from the furnace are utilized to heat the heating chamber and wood gases.

327,804—October 6, 1885. WALTER A. LOVELACE. *Charcoal kiln.*

Claims, in a charcoal kiln, the combination, with a central underground fireplace, having a grate, and a horizontal underground draft-flue, extending from beneath said fireplace to a point outside the kiln, of a portable dome-shaped hood, composed of a single thickness of iron plates, and having doors, a series of lateral openings, near the bottom, and a circular opening at the top closed by a cap.

342,201—May 18, 1886. LEVEN S. GOODRICH. *Apparatus for the manufacture of charcoal.*

Claims a kiln for the production of charcoal having an annular flue below its floor, openings through the floor connecting said flue with the interior of the kiln, a central chamber surrounded by said annular flue and communicating with the latter through suitable openings in the dividing wall, and a pipe extending from said central chamber into and toward the top of the kiln.

342,202—May 18, 1886. LEVEN S. GOODRICH. *Charcoal kiln.*

Claims a charcoal kiln provided with top and bottom inlets, in combination with branch supply-pipes connected with said top and bottom inlets and leading to the source of supply of hot gas, and provided with suitable dampers, whereby said gas may be admitted to the kiln either at the top or bottom, or both.

352,931—November 23, 1886. HENRY M. PIERCE. *Kiln for the manufacture of charcoal.*

Claims, as an improvement in the construction of movable or forest meilers, a rigid removable base section or breastwork having air ports and gas vents, and a soil or similar cap section.

360,238—March 29, 1887. JAMES E. McNAUGHTON. *Charcoal kiln.*

Claims a charcoal kiln consisting of vertical sides and an arched roof formed of sheet-metal plates secured together, rows of supporting pins secured to the ends of said roof and side plates, end plates of the kiln removably sustained by said pins, and upright frames connected by angle irons and eyebolts to the kiln walls.

399,255—March 12, 1889. JOHN FRIEDRICH. *Condenser for charcoal kilns.*

Claims the combination, with a kiln and an outer casing surrounding its lower portion, of division plates dividing the chamber between the kiln wall and casing into several communicating compartments, water pipes transversing said compartments, and connections between the interior of the kiln and the chamber between the kiln wall and casing.

399,634—March 12, 1889. MICHAEL SANDFORD. *Coke oven.*

Claims a coke oven constructed of equal-sized large blocks, having a laterally arched top and a common feed and discharge opening in the middle of said top and a door in its front, in combination with a heavy stone wall, rectangular in shape, provided with a door registering with the above-mentioned door not leaning on the front of the oven, and with its sides rising flush with the sides of said oven, so that when a number of said ovens are arranged side by side the side edges of said walls will be in contact all the way to the tops, and will support the earth packed between the arched tops of adjacent ovens, for the purpose of laying a railway track thereon.

413,306—October 22, 1889. EDWARD WILKES RATHBUN. *Kiln for making charcoal.*

Claims in a kiln for making charcoal, in which the gases are conveyed from the kiln to a condenser and then returned to the combustion chamber of the kiln, the combination of walls provided with flues beginning near the bottom of the kiln and terminating near the top thereof, a chamber for receiving the gases from said flues and having a pipe leading to the condenser, and a perforated combustion chamber, having a passage, and a pipe to convey gas from the condenser to the combustion chamber.

547,271—October 1, 1895. ERIK JOHAN LJUNGBERG. *Continuous charcoal kiln.*

Claims the combination of the kiln compartments, passages from one compartment to the adjoining compartment, a channel leading from each such passage to the chimney or other outlet, a furnace located in each passage to ignite the gases passing from one compartment to the adjoining compartment, and a double water-seal located at the connection of the said channel with the said passage, whereby each compartment may be connected either with the chimney or with the adjoining compartment.

607,331—July 12, 1898. JOSEPH BERRY. *Charcoal kiln.*

Claims a charcoal kiln consisting of a series of longitudinal sticks so laid as to provide lengthwise draft spaces, cross sticks laid thereon, a V-shaped space formed in the front end of the kiln by the proper stacking of the wood, a series of draft spaces formed around the edge of the kiln by the proper overlapping of a series of sticks to the right and left, a block from which these overlapping sticks start, and a block upon which the outer ends of the last of these overlapping sticks rest.

724,601—April 7, 1903. FRANK WOLF NEWBERGER. *Method of making charcoal and of conserving the vaporous distillates thereof.*

Claims the method of making charcoal and of conserving the vaporous distillates thereof, which consists in inclosing the logs to form the charcoal in an air-tight covering having means associated therewith to supply air as requisite to the pile, disposing between the logs, at the lower portion of the pile, downwardly inclined collectors which operate to catch the vaporous distillates as generated within the pile and convey them without the pile, and then condensing the distillates.

744,666—November 17, 1903. BERNHARD ZWILLINGER. *Carbonizing apparatus.*

In a carbonizing apparatus, the combination with a closed kiln, of a conduit leading from the kiln, a compressor, the inlet of which is connected with said conduit, a cooler located in the path of the gas between the kiln and the compressor, a vessel connected with the outlet of the compressor and adapted to hold water to partially deoxygenize any air that may be fed by the compressor, and to charge it with aqueous vapor, a heater connected with the outlet of said vessel, and a connection from the outlet of said heater to the inlet of the kiln so that a mixture of gases and air partially deoxygenized and charged with aqueous vapor will be forced into the kiln at the beginning of the operation.

748,457—December 29, 1903. HENRIK CONSTANTIN AMINOFF. *Apparatus for continual charring and dry distillation of organic substances.*

Claims in a charring and distilling apparatus the combination of an extended, inclined chamber, means for successively transporting the substance to be charred from the lower end of the chamber to its top end, a passage leading gases generated in the chamber from its lower end to the top end, and condensers, a fan and a heating device mounted in the said passage between the said lower end and the top end.

749,091—January 5, 1904. FREDERICK M. PERKINS. *Wood carbonizer.*

Claims, in a wood carbonizer, a carbonizing chamber to receive the wood to be carbonized, a furnace within the walls of the carbonizing chamber and within which heat is generated to carbonize the wood in said chamber, a flue from said furnace having branch flues communicating with the carbonizing chamber, said flue and branch flues also located within the walls of said chamber, and an exhaust flue from the carbonizing chamber.

COKE.

SUBCLASS 4.—COKE OVENS.

128,151—June 18, 1872. THOMAS G. KENNY. *Improvement in coke ovens.*

This invention relates to an improved portable coke oven, particularly applicable to use in connection with iron or other furnaces, whereby coal may be made into coke for smelting purposes at or near the blast furnace, so that the oven may be brought to the furnace at the time required and the coke discharged directly from the oven into the furnace while in a hot state, instead of being made at a distance and transported by cars or other means to the furnace in a cold state. By this means great saving, not only in fuel consumed but also of waste in transporting the coke from place to place, is obtained, and the coke is supplied to the furnace free from hydrogen.

214,086—April 8, 1878. LEON BEMELMANS. *Improvement in coke ovens.*

The invention consists in a coke oven having its top open throughout its length, and having an inclined bottom with a door at the lower end for discharging its contents from gravity, and a perforated false bottom and subjacent flue for carrying off the gases, and also in the combination of valves and doors for controlling and operating the oven.

232,389—September 21, 1880. EDWARD BURNS. *Coke oven.*

Claims in a coking oven, the combination of a ring-shaped smoke flue, extending horizontally around the oven, and at the rear side connected with its interior by a flame aperture and two air-supply flues, each having its inlet at the front wall and extending around the oven below the smoke flue, and at the rear having a connection with the ring-shaped smoke flue, but upon opposite sides of the flame aperture.

235,368—December 14, 1880. CASSIUS C. MARKLE AND ROLAND H. SMITH. *Coke oven.*

This invention relates to an improved construction of apparatus for the making of coke from soft or bituminous coals, wherein the carbonaceous gases from the ovens are carried directly to and through a series of condensers or washers, thence to a holder, and thence through pipes or passages in the inclosing walls of the oven or ovens for the reheating of the same, and are finally discharged in jets into the charge inclosed in the oven.

236,933—January 25, 1881. ARTHUR M. CHAMBERS. *Coke oven.*

The object of this invention is to furnish a device by which air is admitted to the interior of the oven above the burning coal, and directed to the flue leading to the chimney, so that the combustion of gas from the coal can be exactly regulated as desired, and the state of the interior of the oven can be watched at any time by an attendant, or its temperature tested by a pyrometer.

253,182—February 7, 1882. JOSEPH H. CAMPBELL. *Apparatus for extinguishing fires in coke ovens.*

This invention consists in the combination of a furnace, steam-jet pipe, water pipe, trap, and coke oven, arranged and operating with relation to each other so that the carbonic acid gas generated in the furnace is drawn therefrom through the medium of the steam jet and pipes and cooled and forced into the coke oven and into and among the burning coke, thereby extinguishing the fire and adding carbon to the coke.

258,489—May 23, 1882. WILLIAM B. SMITH. *Coke oven.*

The object of this invention is to provide simple and effective means for desulphurizing the coke, whereby the latter is better adapted for use in metallurgical furnaces and the iron or product obtained from the same is of a superior quality. To these ends the invention consists in a coke oven of any desired form or construction, which is traversed by a system of horizontal tubes that serve for the circulation of water and air through the same. The products of combustion in the oven will tend to generate a sufficient amount of steam in the tubes, which escapes through openings in the upper side of said tubes, and is readily decomposed in the oven, furnishing hydrogen and oxygen, that combine with the sulphur in the coal and carry it off.

276,002—April 17, 1883. BRODIE COCHRANE. *Coke oven.*

This invention has for its object to so construct the coke ovens as to utilize to the utmost the otherwise waste heat radiated from them for heating the air supplied to the interior of the oven, and at the same time to protect them from the loss and irregularity of heat which occur at the upper part as ordinarily constructed, when the roofs or domes, being exposed to the open air, are liable to great and sudden changes of temperature owing to winds, rain, snow, and atmospheric influences. These improvements effect not only an increased yield of coke, but also a considerable saving in the time necessary for coking and cover in Claim 1 a coke oven having over its ordinary dome a second dome with walls forming a series of communicating air flues, with an air inlet to the flues at one point and an air exit into the interior of the oven at another point.

287,433—October 30, 1883. HAYDEN H. HALL. *Gas and coke kiln.*

The invention consists in a kiln open at top, for charging and lighting, and having a removable cover, and also a blast and exhaust pipe or flue traversing it at the line of the base, floor, or grate of the charge-receiving chamber, another chamber being provided below the charging chamber, to receive the coke of each charge by the fall of the sectional floor or grate at the sides of the blast pipe, and further in special constructions of the blast or exhaust pipe in pyramidal cross-sectional form, and with higher and lower rows of exhaust apertures controlled by independently working dampers, and protected by overhanging plates or hoods from the drip of the residual tar from the coal. The exhaust pipe being suitably valved at the gas-discharge end, and fitted with a movable head at the opposite end, having telescopic connection with the valved outlet of the blowing engine or steam blast, for a controllable blast supply and for a means of cleaning the blast pipe, which communicates with suitable gas receivers for storing the gases or conveying them for use, and further, in the arrangement within the walls of the charge-receiving chamber fitted with a removable cover, and for charging and firing the charge from the top of the kiln, of pipes fitted with nozzles for ejecting superheated steam into the charged coal during the coal gas generating process, for increasing the downward draft and producing hydrogen gases, to mingle with the coal gases for intensifying the useful heating effect of the gaseous product.

289,887—December 11, 1883. JOSEPH BUTLER. *Coke oven.*

The invention consists in the combination, with an oven and its main discharge flue or stack, of draft passages arranged in the sides of the oven and adapted to admit air to the interior of the oven, and escape passages for conveying the products of combustion to discharge flues arranged independently of the main flue, and special features of construction and combinations of parts.

308,514—November 25, 1884. THOMAS NICHOLSON. *Apparatus for coking and collecting the resulting gases and their products.*

Claims a coking oven and pipe leading therefrom, combined with main and branch pipe and main provided, respectively, with valves and separate condensers, whereby early products or illuminating gas may be separated from the later product or heating gas and separately treated, as set forth.

420,897—February 4, 1890. WILLIAM W. ANDERSON. *Coke oven.*

Claims a coke oven having in combination a bed provided with a retaining ring and a removable dome or hood resting upon the bed outside of the retaining ring.

427,210—May 6, 1890. COLIN CAMPBELL WYLLIE. *Apparatus for utilizing waste gases from coke ovens.*

Claims the combination, with a furnace adapted to produce combustible gases, of a gas main or conduit leading therefrom, and a pneumatic pump whose cylinder and valves are indirectly connected with the gas conduit by means of branch pipes, whereby a body of dead gas is interposed between the main conduit and the cylinder.

459,064—September 8, 1891. ARTHUR MARSHALL CHAMBERS AND THOMAS SMITH. *Coke oven.*

Claims a coke oven provided at the top on one side with an outlet flue, an air-blast pipe discharging into the said oven below said outlet flue, but on the opposite side of said oven, a tubular outlet extending outward and downward from the lower part of said flue, a regulator in said flue above the outlet pipe, and a regulator in the latter pipe.

464,844—December 8, 1891. JOHN A. BECK. *Means for utilizing waste heat from coke ovens.*

Claims the combination, with a series of open topped ovens, of a fluid-containing vessel above the same and draft stacks or vents extending from said ovens through said vessel, each of said stacks or vents having a flaring lower end arranged at the inner end of a plurality of adjacent ovens and communicating with and carrying the waste heat from said plurality thereof.

469,866—March 1, 1892. THOMAS R. OSBOURN. *Coke oven.*

Claims in a coke oven, a structure forming a pit and a beehive oven situated above the same, and embodying in its masonry vertical lift channels, bores or tunnels exterior to the oven and extending from the top of the structure to the pit and terminating at their lower ends immediately over a movable floor, and lifts situated within said channels.

470,506—March 8, 1892. JOHANNES REITER. *Coke oven.*

The ordinary beehive ovens employed in the production of coke produce the best sort of coke, known as "patent coke," but have the drawback that they only produce a small output in consequence of the considerable burning away of the coal. This waste results from the inlet of air consequent on these ovens not being hermetically closed during working. In them the process of driving off the gases proceeds from top to bottom within the oven in consequence of air supplied from the outside, and coals having about twenty per cent of gas produce about sixty per

cent of coke. When such ovens are modified to admit of the recovery of the by-products contained in the oven gases and are altered so as to effect the hermetic closure necessary for the process of distillation, the gases generated in the ovens and freed in the condensation apparatus from the by-products are led under the floor of the oven for the purpose of heating it. By this modification it has been rendered possible to increase by sixteen to twenty per cent the output of coke produced in such ovens, which are thus transformed, as it were, into retorts, while obtaining a product of the same quality and commercial value as the coke produced in ovens of the old form; but, since these beehive ovens as altered for distillation working are heated from the floor only, the time required for the coking process is considerably greater than in ovens of other systems that are heated both from the floor and sides. The time required for coking in the aforesaid modified ovens is almost double that of the last mentioned ovens with the same charge and the same dimensions.

The present invention relates to the construction of an oven in which not only fine patent coke can be produced, but in which also the time required for coking is brought down to the reduced amount required for ovens of the more modern systems. This oven can also be employed for ordinary coking in lieu of the beehive ovens of the old form with small output. When it is so employed without any attempt being made to effect the recovery of by-products, the time required for coking is reduced by utilizing the raw and powerful gases generated within the oven. These gases are made to heat the oven from the sides simultaneously with the heating from the floor, thus effecting the driving off of the gases and also the complete shutting off of air from the interior of the oven, and in this manner the output is considerably increased. An oven of this kind is adapted to be employed not only in the production of coke from gassy fat coals, but also from a mixture of dust from dry coals or dust from flaming coals with coal tar or gas coals containing sufficient gas for coking. This oven is also adapted for producing coke from briquettes or blocks made from a mixture of coke waste and dust from dry coals or dust from flaming coals with a percentage of coal tar of six to eight per cent or fifty-eight per cent. If the content of gas of such a mixture be not sufficient alone to permanently maintain the heating of the sides and the floor of the oven, the oven can be connected with any existing battery of ovens and can take from it the requisite additional quantity of gas necessary for coking.

The drawing of the coke from an oven of this kind is effected by manual labor in a similar manner as in the ordinary beehive oven or in beehive ovens that have been transformed for the purpose of recovery of by-products, since a drawing machine is not effective in consequence of the round form of the said ovens. Since a drawing operation requires much time, the glowing coke must be cooled by quenching within the oven in order to prevent loss by the burning of the coke in consequence of the continued influx of air when the oven door is opened.

For two reasons the circular beehive form has been departed from in favor of an elliptical cross-section in which the major axis exceeds the minor axis in length by about one-fourth. One reason is that in a circular oven sufficient width of door for the drawing out can not be readily obtained without interference with the side flues, which occupy the parts of the periphery of the oven that are necessary for the oven door. Another reason for adopting the elliptical form is to obtain a large area of floor of a larger charging space. In an elliptical oven the door can be arranged on the side of the oven fronting the major axis at the point where the side flues are situated which are farthest apart and between which there is sufficient space for accommodating the door.

And the inventor claims a coke oven having a central chamber, a series of parallel flues beneath the floor thereof, arranged in two sets, a series of wall flues connecting with the parallel flues and opening into the space above the dome, division walls in said space, and a door opening to said central chamber above the line of the floor flues.

471,033—March 15, 1892. RICHARD DE SOLDENHOFF. *Coke oven.*

Claims the combination, with the ovens and the collecting flues communicating therewith, of gas flues formed in the side wall of said ovens and having communication with said collecting flues, a smoke flue, gas flues arranged under the ovens and communicating with the aforesaid gas flues and with said smoke flue, an air-inlet flue, and connected flues forming one continuous flue, having connection at one end with said air-inlet flue and at the other with the gas flues in the side walls of the ovens and being arranged under the gas flues.

471,692—March 29, 1892. HERMAN EKELUND. *Coking oven.*

This invention relates to improvements in furnaces for charring, roasting, baking, or coking wood, coal, or other material. This furnace consists of 3 principal chambers or compartments A, B, and C, of which chambers, A is for drying and heating, B for baking, charring, roasting, or coking, and C for extinguishing and cooling the roasted, charred, or coked materials received from chamber B. The chamber or compartment B is separated at its ends by partition walls from the adjoining compartments D and E. The compartments A and B are separated from one another partly by double-vaulted floors containing two channels and partly by sliding doors, by which the openings or passages between the compartments may be opened or closed. The compartments B and C are separated by vaulted floors, containing each only one channel, and by sliding doors in said floors. In the compartment C iron tanks or cisterns are placed. The furnace is covered by a vaulted roof or cover provided with the doors, a funnel or chimney, and an exhaust fan. The compartments A and B are to be filled with the materials to be operated upon. From a fireplace situated outside of the furnace the heat is conducted through an opening into the compartment D, through openings into the lower channels G, passes thence downward through holes in the bottoms of the said channels, into the compartment B, and effects there the charring, baking, roasting, or coking of the materials placed in said compartment B. The gases produced thereby pass through perforated or grate-shaped vaulted bottoms of the compartment B into the channels and from these through pipe into a tank or cistern, the circulation being maintained by means of a fan placed upon the latter. The gases proceed then through a pipe into the compartment E, the latter constituting a fireplace where the gas is ignited. Water and tar are condensed in a tank or cistern. From the compartment E the gases are conducted up into the channels and through openings in their roof into the compartment A.

472,115—April 5, 1892. WILLIAM T. GATES AND GEORGE H. SHARP. *Coke oven.*

The objects of this invention are to provide means for spreading or leveling the coal within the oven, for removing the coke from the oven, for separating the coke from the ashes, and for loading the coke into cars for shipment. And the inventors claim the combination, with an oven open at one end, of a plunger terminating at one end in a transverse head provided at its rear side with rearwardly disposed wings arranged parallel to each other and at opposite sides of the plunger, and means for reciprocating the plunger.

514,546—February 13, 1894. NILS KARL HERMAN EKELUND. *Coking furnace.*

Claims a coking furnace comprising a drying chamber extending across the upper part and divided into two parts by a horizontal partition wall, provided with doors, a central partition wall beneath the drying chamber having a conical apex, grated doors opening in each side of the conical apex and leading to coking chambers.

523,397—July 24, 1894. THOMAS CUMMINGS AND JOSEPH CUMMINGS. *Coke oven.*

Claims a coke oven consisting of a longitudinal chamber having arched openings at each end of the chamber, the openings formed the full width of the chamber, the jambs of the openings provided with metallic lazy bar supports, a chamber arch supported on the side walls, the chamber arch provided with tunnel heads, the tunnel heads being provided with dampers to partly cover the openings to desulphurize the coke.

523,602—July 24, 1894. ALBERT DICKINSON SHREWSBURY. *Coke oven.*

Claims in a coke oven, an intermediate chamber in the upper part of said oven, a division therein forming two parts, an air passage from the outside opening into one part of said chamber, an exhaust opening into the other part of said chamber, and a series of passages between said oven and both parts of the intermediate chamber.

538,898—May 7, 1895. FRANZ JOSEPH COLLIN. *Horizontal coke oven.*

Claims a coke oven provided with essentially horizontal chambers or ovens, channels arranged directly above the said chambers and communicating therewith, longitudinal passages extending between the said channels and communicating therewith, said passages being divided into two parts at approximately the center of the oven, sinuous channels arranged in the side walls of the oven and connected to the said passages at the ends of the oven, essentially horizontal flues located below the said sinuous channels and communicating therewith at the central portion of the oven, and bottom channels connected to the said flues and of which each two communicate with each other so as to cause the gases from either of the ovens or chambers connected to the said channels to pass successively under each of the ovens through the said two bottom channels, one of each two bottom channels being connected with a smoke flue.

596,753—January 4, 1898. JEANNOT W. KENEVEL. *Apparatus for coking and desulphurizing bituminous coal.*

Claims an apparatus for coking and desulphurizing bituminous coal, comprising, in combination, a structure containing a retort, a mixing chamber below the retort, a gas chamber below the opening into said mixing chamber, a base flue connected by ducts with said mixing chamber, air passages connected by ducts with said base flue, flues, passages connecting the mixing chamber with said flues, and steam-supply pipes leading through the passages into said retort, a steam generator with which said steam pipes are connected, a stack into which said flues discharge, a hydraulic main, a sulphur flue, a sulphur-intercepting chamber into which said sulphur flue discharges, and a pipe having valve-controlled branches and leading, respectively, to said sulphur flue and hydraulic main.

660,480—October 23, 1900. EDWIN A. BABBAGE. *Coke oven.*

Claims a battery of ovens, comprising parallel walls, two rows of ovens arranged between the walls with the ovens of one row opposite the spaces between the ovens of the other row, said ovens having door openings leading through the aforesaid walls, smoke passages leading from the rear walls of the ovens at a point about opposite the door openings and in line with the top portions thereof and communicating with vertical passages or stacks located between adjacent ovens and in line with the openings formed in the crowns thereof, pillars at the sides of the horizontal portion of the passages and extending thereover and to a point above the crowns of the ovens, and rails supported upon said pillars, the spaces between the longitudinal walls and the ovens being filled with earth or the like.

680,790—August 20, 1901. WILLIAM JOHN KNOX. *Apparatus for the manufacture of coke.*

Claims the combination of a superheater, one or more coking chambers, an inlet or outlet to each chamber at its upper part, a fixing chamber connected with the outlet of the coking chamber or chambers, means for continuously circulating gas through the heating chamber and the coking chamber or chambers in contact with the coal and coke and through the fixing chamber, and means for withdrawing and utilizing a regulable amount of the gas.

680,791—August 20, 1901. WILLIAM JOHN KNOX. *Apparatus for manufacturing coke and gas.*

The general plan of the invention is to pass the hydrocarbon vapors generated in coke ovens through suitable stoves in which more or less of the heat carried by the vapors is conserved or stored, thence through cooling devices—such, for instance, as a steam generator—and thence into heating stoves, where the temperature is raised to the degree required for effectively acting upon the coal to reduce it to coke. These heated vapors are then passed into the coking ovens and usually across the top of the bed of coal or coke. This operation is continued until the stove which has been employed as the heat-absorbing stove has absorbed and stored a predetermined amount of sensible heat, whereupon the direction of circulation is reversed and this stove is utilized as the heating stove and the former heating stove as the heat-absorbing stove, and this operation of reversal is repeated continuously at suitable intervals as long as the temperature of the stoves is sufficiently high to conduct the coking operation. Additional stoves may be employed, so that any stove which has previously been used as described and its temperature reduced thereby may be cut out of the circuit and further heated by the consumption of fuel therein to restore its condition as a heating stove. And the inventor claims the combination of one or more coking ovens, means for passing a heated fluid carrier through the coking ovens, means for cooling the fluid carrier as it passes from the coking ovens and means for reheating a regulable amount of the fluid carrier for retransmission therethrough.

681,064—August 20, 1901. RICHARD DANIEL MARTIN. *Drawing machine for coke ovens.*

A drawing machine having a scraper, comprising a scraper guideway, a scraper beam mounted to slide thereon, a scraper blade hung on said beam, a horizontally arranged shaft on which said guideway is fulcrumed to swing up and down, means for actuating the scraper beam from said shaft, a vertical shaft on which one end of said horizontal shaft is fulcrumed, whereby the said horizontal shaft and the guideway may be swung laterally, gearing between the said shafts, and a shaft arranged to drive the said vertical shaft and on which the latter is mounted to swing.

690,748—January 7, 1902. RICHARD D. MARTIN. *Coke oven.*

Claims adjoining coke ovens separated by an intervening wall having a V-shaped passage leading directly from one oven to the other through the outer part of the masonry, in combination with means for opening and closing said passage.

701,219—May 27, 1902. PAUL NAEF. *Apparatus for the manufacture of coke.*

The object of this invention is to provide an apparatus to produce coke or to coke coal in a single furnace in much larger quantities than has been done heretofore and on a scale commensurate with the requirements of a blast furnace and to utilize the by-products. Further to provide an apparatus to do this with a small waste of heat, so that the heat units required for the distillation only are consumed, the remaining heat units being retained in the coke and gas; to in-

crease the production of ammonia by the action of superheated steam on the coke in an incandescent state; to utilize the heat of the incandescent coke for producing steam and superheating the same; to make the coking of the coal and the cooling and loading of the coke wholly automatic; to manufacture fuel and illuminating gas, as well as tar, ammonia, and coke; to reduce the cost of plant investment and repairs per ton of coke, and to effect great economy in the cost of production and in the utilization of the by-products and also to construct the apparatus so as to utilize the nitrogenous components which are with ordinary coking processes left in the coke (and which represent usually more than fifty per cent of the nitrogen contents of the coal) for the production of ammonia, while providing an apparatus by means of which to produce a coke with a low percentage of ashes and to avoid the combustion of coke in the coking apparatus, the heat necessary for the coking being supplied from a separate heating apparatus. And the inventor claims a coking apparatus consisting of a shaft provided at its lower end with a coke outlet and having inlets for gaseous fluid, inlets for steam at a lower level than the gaseous-fluid inlet and inlets for water at a still lower level all of said inlets being above the coke outlet.

705,681—July 29, 1902. RUDOLF KUHN. *Process of making the interior of coke ovens or other kilns tight.*

Claims a process of making the interior of coke ovens and other kilns tight which consists in mixing fine ore-dust with fine-ground ashes or other dusty material and then blowing the mixture into the hot chamber, the walls or sides of which are intended to be tightened, the effect being that the dust will keep floating for a while and then settle by degrees in the pores and cracks and thereby make the walls perfectly tight.

707,914—August 26, 1902. WILLIAM T. GATES. *Coke oven.*

The invention consists in arranging the forty-eight hour or furnace-coke producing oven on a plane below that occupied by the seventy-two hour or foundry-coke producing oven and in directing the heat from the forty-eight hour oven into and beneath the floor of the seventy-two hour oven, and thence entirely around the lower portion of the side walls thereof. The improvements hereinafter described are equally adaptable to seventy-two hour ovens having either single or double walls, the result being affected in the former case by providing externally arranged flues around the lower portion of the oven to receive the heat from the forty-eight hour oven and in the latter case by providing an internally arranged flue between the walls of the lower portion of the oven.

711,500—October 21, 1902. JOHN M. HUNKER. *Coke oven.*

Claims a coke oven in the walls of which is arranged a series of blocks, said blocks formed with centrally arranged longitudinal and transverse openings, said transverse openings communicating with each other, thereby forming a continuous passage, and the longitudinal openings forming a series of direct communication between the exterior and the interior of the coke oven.

711,904—October 21, 1902. THADDEUS S. C. LOWE. *Apparatus for the manufacture of coke and the recovery of gases therefrom.*

Claims the combination of a plurality of coke ovens, passages connecting the ovens above the coke line, a superheater and a steam generator at each end of the ovens, passages forming communication between the superheaters and the ovens, and passages forming communication between the steam generators and the superheaters, means for admitting air to either end of the apparatus, and means for admitting water to the steam generators, exhaust passages in each steam generator, and means for carrying off the resultant gases.

718,008—January 6, 1903. THADDEUS S. C. LOWE. *Air heater and steam generator.*

Claims the combination, in an apparatus for making gas from coking coal, of a coke oven, a steam generator on each side thereof and communicating with the coke oven above the coking line, upper and lower sets of metal bars or ironwork in said generators, a valved air inlet communicating with each of the generators above the said upper set, a steam or water supply pipe communicating with each of the generators between the said upper and lower sets, a waste-gas outlet for each of said generators, and a gas outlet from each of said generators.

722,982—March 17, 1903. LOUIS J. HIRT. *Coking oven.*

This invention relates to a coking oven wherein the process of coking a plurality of grades or kinds of coal may be simultaneously carried on without interfering one with the other or wherein a single grade or kind of coal may be coked. For this purpose the coking oven is provided with a plurality of retorts or chambers which communicate at their upper ends with a gas-outlet passage or flue separated from the coking chambers, except as to the gas-outlet ports, by a wall of refractory material, which serves to prevent the gas in the passage from being influenced by the heat of the coking chambers to such extent as would destroy the light hydrocarbons. The gas-outlet passage or flue referred to may be designated the "main" outlet passage and has communicating with it a second gas-outlet flue or passage, which may be placed in communication with one or more of the coking chambers by means of one or more valves in the main outlet passage, so that a rich kind or grade of coal in one or more of the coking chambers and a poorer grade or kind in the other of said coking chambers may be coked simultaneously, and the richer gases may be carried off through the main flue or passage and utilized for illuminating or for other purposes and the poorer gases may be carried off through the second outlet passage and utilized for heating the ovens or coking chambers or for other purposes.

724,032—March 31, 1903. GEORGE FRANCIS MYERS. *Coke oven.*

The main characteristic feature of this invention consists in providing a U-shaped floor for the oven, while retaining the dome shape of the present beehive oven, preserving all the advantages of the beehive oven—such, for instance, as its good coking qualities—but dispensing with the small door in the front part thereof, providing in lieu of said door a door equal in width to the full width of the oven, thereby facilitating the discharging of the coke from the oven.

725,646—April 14, 1903. ROBERT S. MOSS. *Coking oven.*

Claims, in a coking oven, the combination with the coking chamber, of a series of air-discharging apertures or openings in the wall of the oven, each aperture or opening having a lateral inclination for projecting air into the coking chamber at an angle and giving a circulation thereto around and within the coking chamber, a bottom for the coking chamber, an air-supply chamber in the bottom, and a flooring or covering for the air-supply chamber having perforations or slits therein gradually increasing in width from the point of admission to the side farthest removed from the admission of air.

732,097—June 30, 1903. CASPAR W. METTLER, ADOLF METTLER, AND JACOB METTLER. *Coking kiln.*

Claims a kiln having two coking chambers with brick side walls, center wall and roof, and iron doors at both ends, tracks extending through the coking chambers, a furnace extending transversely below one end of the coking chambers, flues extending through the walls from the combustion chambers of the furnace and opening into the top and bottom of the coking chambers, dampers for controlling the openings from the flues into the chambers, flues extending longitudinally under the bottom of the coking chambers to a tank and a stack communicating with the tank.

733,872—July 14, 1903. GEORGE SHARPE RAMSAY. *Coke oven.*

Claims a coke oven having a charging opening at the top thereof, a door in the front of the oven for withdrawing the coke, a stack located in rear of the oven, a main flue located centrally below the floor of the oven with its front end piercing the front of the oven wall and its rear end in communication with the stack, a damper door for the front end of the flue, substantially radial flues at opposite sides of and in communication with the main flue and permitting the products of combustion to pass directly to the stack, other radial flues terminated short of the main flue, transverse flues connecting the radial flues and also in communication with the main flue, and independent upstanding flues upon the exterior of the oven wall with their upper ends piercing the oven wall for communication with the interior of the oven and their lower ends in communication with the flues beneath the floor at the points of intersection between the outermost transverse flues and those radial flues which terminate short of the main flue, the upstanding flues being located at opposite sides of the main flue and at the front and rear of the oven.

740,078—September 29, 1903. THEODOR VON BAUER. *Coke oven.*

Claims the combination of a battery of coke ovens, air channels located in the foundation of the same, intermediate channels located between the sole channels and the crown of the air channels, channels connecting the air channels with said intermediate channels, combustion flues in the partition walls between the ovens, gas-distributing and return-gas flues above said combustion flues and connected therewith, air-supply pipes terminating in openings at the upper parts of said combustion flues, and connected with the intermediate channels, and a sole channel connected with the lower ends of the combustion flues.

744,668—November 17, 1903. BERNHARD ZWILLINGER. *Apparatus for carbonizing.*

Claims in a carbonizing apparatus, the combination of a kiln, a heater for gases having two separate channels, channels located under the kiln, and connection from one of the channels of the heater to said channels under the kiln, a cut-off device located in said connection, a device located in said connection between the cut-off device and the kiln for connecting the channels under the kiln with the atmosphere at their supply end, or closing said channels to the atmosphere at said end, a draft device connected with the outer end of the channels under the kiln, means for conveying a gaseous mixture to the outer channel of the heater, and a connection through the outlet of said outer channel to the interior of the kiln.

745,290—November 24, 1903. PAUL NAEF. *Apparatus for the manufacture of coke.*

Claims the combination in a coking apparatus having two chambers, of hollow doors between said chambers, having a partition, and the hollow revoluble shafts to which the doors are secured having a partition, and a cooling ring formed in sections, and surrounding the doors, and with the shafts extended therethrough, means for circulating water from a water supply through the shafts, doors, and ring, comprising an induction pipe, having branches joined to one end of the shafts so that the latter can be revolved, an induction pipe from said branch to the ring, a discharge pipe connected to said water supply, and having branch pipes with rotary joints at the other end of the shafts, and a discharge pipe from the said ring to the said discharge branch.

760,372—May 17, 1904. JACOB B. BEAM. *Coke oven.*

Claims the combination of a series of ovens, a main flue running parallel with the ovens below the top level and communicating with the ovens by branch flues which enter the ovens above the coke level and close to the filling orifices of the ovens, valves in the branch flues controlling the passage of gases from the ovens to the main flue, a furnace close to the ovens and connected with the main flue by a branch flue and a valve in said branch flue for regulating the admission of gases to the furnace and which when closed causes the gases to back up into a recently charged oven.

761,521—May 31, 1904. JOSEPH SPEAR MAXWELL. *Coke oven.*

Claims the combination with a long series of coke ovens arranged in a single structure, of pairs of end ovens spaced from the structure, each oven being rectangular in cross area and having an arched top provided with a central vent, brace beams extended upward along the end walls of the pair of ovens, tie rods connecting opposite beams above the ovens, braces extended across the spaces between adjacent walls and connecting said walls, a packing of dirt or the like supported on the ovens, and car tracks extended along over all of the ovens at one side of the vents.

763,368—June 28, 1904. MICHAEL R. CONLEY. *Electric coke oven.*

Claims a coke oven of nonconducting material open at the top and provided with swinging doors at the bottom which open the full bigness of the oven, and electric resistance-plates held in the inner wall of the oven to heat it, the entire height of the oven being left clear and unobstructed.

769,246—September 6, 1904. JASPER H. BOWLING. *Coke oven.*

Claims in a battery of beehive coke ovens the combination with an oven, of a substantially straight, horizontal main flue located adjacent to one side of and below the floor of said oven and communicating at one end with the exterior, a similar main flue located at the opposite side of said oven, a chimney with which said second flue communicates, a plurality of substantially straight and parallel cross flues extending from the first mentioned flue to the second, and a flue leading from the interior of an adjacent oven into said first mentioned main flue, said cross flues being constructed of tile of rectangular cross section and said main flues having their upper walls composed of plate tiles resting by one edge upon the tiles which form said cross flues.

773,809—November 1, 1904. GEORGE S. RAMSAY. *Coke oven.*

Claims a coke oven having a stack, and provided with a central main bottom flue communicating at one end with the stack, front and rear upstanding flues communicating at their upper ends with the interior of the oven, and the independent front and rear bottom flues connecting the upstanding flues with the main bottom flue, the rear bottom flues being shorter than the front bottom flues, and the walls separating and forming the front and rear bottom flues being continuations of the outer walls of the oven to provide continuous supports for the floor of the same.

786,694—April 4, 1905. JAMES M. SULLIVAN. *Coking oven.*

Claims in an apparatus for coking coal, the combination with a plurality of ovens arranged in parallel series, of party walls separating adjoining ovens through which passages extend, a flue extending between the series of ovens having passages communicating with the individual ovens in each series, dampers controlling said passages in the walls and in the flue whereby alternate ovens in each series may communicate with said flue through the adjoining ovens, and means for forcing air through said flue thereby promoting the draft through the ovens.

793,668—July 4, 1905. DANIEL F. LEPLEY. *Coke-oven attachment.*

Claims in apparatus for the utilization of waste gases from coke ovens a stationary coke oven having a charging hole at the top of the oven, and through which a charge of coal may be deposited in said oven, a gas conduit, a valveless duct leading from the conduit toward the oven and opening at the top of the oven, and a pivotally mounted flue member movable to establish communication between the hole and duct, and for closing communication between the duct and the outer air.

Subclass 5. Coke Ovens—Chargers and Dischargers.

61,144—January 15, 1867. SEALY JAMES BEST AND JAMES JOHN HOLDEN. *Improved apparatus for charging and drawing gas retorts, and other like purposes.*

Covers a system of scoops and scrapers mounted on a traveling platform.

75,308—March 10, 1868. JAMES F. SNEDIKER AND WILLIAM F. BAILEY. *Improved apparatus for charging gas retorts.*

Claims a truck and its swivel bearings in combination with a series of scoops, the handles of which rest on and slide in the said bearings, a sliding bottom, in combination with a scoop, a scoop, consisting of adjustable sidepieces, and bottom pieces constructed, arranged, and connected to a handle, and wheels in combination with a scoop.

94,045—August 24, 1869. N. O. J. TISDALE. *Improved machine for charging gas retorts.*

Claims a guide-way, a charger, when provided with reversible bottom or apron, and the combination of the guide-way and charger.

109,940—December 6, 1870. THOMAS PRICE. *Improvement in coke furnaces.*

Claims a cradle placed in a coke furnace to serve as a grate and conveyor for the coal, a coke furnace provided with curved smoke channels, and a furnace arranged in line with the coke furnace to receive the cradle containing the coke.

114,682—May 9, 1871. JAMES JOHN HOLDEN. *Improvement in apparatus for charging and discharging gas retorts.*

This apparatus for charging and discharging gas retorts comprises a traveling frame, carrying a set of scoops, feeders, or charging tools or instruments on one side, and a set of rakers, rakes, clearers, or drawing or discharging tools or instruments on the other side, and having a to and fro motion on a traversing frame or carriage. The set of scoops or charging instruments and the set of rakes or discharging tools or instruments are mounted and arranged, each set respectively, on an upright spindle, or on a framing on the carrier, so that each set is capable of being swung, turned, or moved partially around, in order that such set may be brought either lengthwise of or at an angle to the general body of the apparatus, as required.

120,151—October 24, 1871. DARIUS DAVISON. *Improvement in the manufacture of coal gas.*

Claims the process of manufacturing coal gas by dividing the usual whole charge into two equal parts, or thereabout, and depositing each fresh supply of a divided charge in rear of the retort and successively distributing a series of such partial whole charges within the retort at intervals in a progressive manner from the rear toward the mouth of the retort.

127,144—May 28, 1872. LA FAYETTE BLAIR. *Improvement in gas retorts and apparatus for charging.*

The first part of the invention relates to the construction of the gas retort, which is built up in masonry in the usual manner. Both ends of the retort extend outside of the walls, the front end for the convenience of filling the coal magazine and the rear end for discharging the coke. The magazine is attached on the top and near the front end of the retort. The contents of the magazine are kept in their place by the slides which pass into the conductor of the magazine. The second part of this invention relates to the combination of the coal distributer and the coke scraper.

130,388—August 13, 1872. ROBERT PORTER AND THOMAS LANE. *Improvement in gas apparatus.*

Claims a retort in combination with a central rotating screw, having a sloping or inclined thread adapted to cause the coal to pass through the retort in close contact with the heated surface of the retort.

131,564—September 24, 1872. THOMAS F. ROWLAND. *Improvement in machines for charging gas retorts.*

Claims a scoop, with suitable supporting means, and having a removable bottom, and valves, combined and arranged for joint operation, and a removable bottom corrugated longitudinally, in combination with correspondingly formed valves and curved sides adapted to match in a D-retort, and reciprocate separately therein.

134,055—December 17, 1872. ALONZO F. HAVENS. *Improvement in apparatus for charging gas retorts.*

Claims a scoop for charging gas retorts made in two or more segments, and each segment hung at the ends upon separate center studs, in combination with mechanism, for giving to the segments a swinging movement to discharge the contents into the retort.

134,056—December 17, 1872. ALONZO F. HAVENS. *Improvement in apparatus for charging gas retorts.*

Claims a chute, in combination with a coal hopper and mechanism for sliding in and withdrawing the chute so as to receive its supply of coal while being moved into the retort, and scrapers or detainers combined with the chute for causing the delivery of the coal into the retort.

134,399—December 31, 1872. THOMAS F. ROWLAND. *Improvement in apparatus for filling gas retort chargers.* (*Reissue No. 7,631, April 24, 1877.*)

Claims a cylindrical measure or meter, consisting of a revolving barrel or cylinder, having an opening for the reception and discharge of coal and arranged to be revolved completely around its axis, in combination with a hopper, and one or more guides for measuring and transferring coal into the retort chargers.

137,485—April 1, 1873. THOMAS F. ROWLAND. *Improvement in apparatus for charging gas retorts.*

This invention provides buckets adapted to receive the charges of coal laterally at the proper point, and carry them by means of a suspended railway along the fronts of the retorts, dropping the coal automatically at the required points by opening the bottoms of the several buckets.

137,486—April 1, 1873. THOMAS F. ROWLAND. *Improvement in apparatus for raking gas retorts.* (*Reissue No. 7,592, April 3, 1877.*)

Claims a rake and rake carriage, combined with mechanism which, upon the forward motion of the carriage, automatically raises the rake, so that it passes into the retort free of the coke, and which, upon the backward motion of the carriage, drops the rake into the coke.

137,487—April 1, 1873. THOMAS F. ROWLAND. *Improvement in gas retort chargers.*

The apparatus described in the inventor's previous application for patent for charging gas retorts has a revolving meter with only one aperture. A certain period is required for any meter to fill properly with coal, and, again, a certain period for it to empty. The present improved apparatus provides a larger revolving meter with an increased number of apertures and chambers, so that one may be filling while another is emptying. It allows for the convenient changing of the capacities of the chambers by the insertion and removal of pieces. This allows the meter to be charged as the retorts become gradually filled or encumbered with gas carbon. It provides automatic mechanism for changing the position of the deflectors or valves that determine into which of the retorts the charge shall be placed. It provides steel knives for better cutting off the coal when an aperture in the meter passes out of contact with the supply passage. It also provides checks for retarding the motion of the coal in descending to reach the lowermost of the retorts, which tends to equalize the velocity of the coal in passing into all the several retorts.

140,624—July 8, 1873. ALONZO F. HAVENS. *Improvement in apparatus for charging gas retorts.*

Charging scoops for gas retorts have been made for delivering the contents into the retort by drawing aside a divided segmental bottom. This present invention is for accomplishing the same object, but by different mechanism, consisting of a bottom to the scoop made of two leaves hinged together in the middle, lengthwise of the scoop, and attached to arms that are employed for lifting up the central portion of the hinged bottom, so as to draw in the edges and allow the coal to be delivered off the leaves in their inclined positions toward the angles of the retort, so as to be more easily and evenly spread upon the bottom of the retort than in those cases where the coal is delivered in the center of the retort.

143,039—September 23, 1873. JOHN SOMERVILLE AND JOHN ROBINSON. *Improvement in apparatus for charging gas retorts.*

Claims the combination of a cradle, having detents or stops arranged in pairs on rocking spindles, with vertical rakes and operating levers.

144,526—November 11, 1873. WILLIAM FOULIS. *Improvement in apparatus for charging and drawing gas retorts.*

Claims an apparatus for charging or drawing retorts, in which the scoop or rake is combined with and operated by the piston rod of a water or other fluid engine.

148,841—March 24, 1874. PETER MUNZINGER. *Improvement in gas retort chargers.*

The invention consists, first, of a revolving scoop carrier in connection with a wagon or other suitable carrying device; second, of a revolving scoop carrier in connection with suspension or scoop carrying devices; third, of a revolving scoop-carrier in connection with geared wheels for working the same; fourth, of a revolving scoop carrier in connection with a ratchet wheel and a detent for holding the said scoop carrier in any required position.

149,836—April 21, 1874. JOSEPH H. CONNELLY. *Improvement in apparatus for drawing coke from ovens.*

This invention consists in a long-handled hook and fork, forming a pair of tongs mounted on a carriage, with which the coke is grasped and removed from the oven; or a long-handled hook mounted in a similar carriage.

160,490—March 2, 1875. JOHN WEST. *Improvement in chargers for gas retorts.*

This invention consists, mainly, in the peculiar construction of a charger or carriage adapted to convey coal into the retort, and distribute the same in an even layer throughout its entire length. It consists, further, in the combination of the charger with the retort, and a hopper for supplying it with coal without rendering necessary the opening of the retort.

165,667—July 20, 1875. WILLIAM FOULIS. *Improvement in apparatus for charging retorts.*

Claims the combination of a scoop, capable of both longitudinal and rotary movements, a hauling chain connected at both ends to and lapped in opposite directions round the scoop, and appliances for imparting motion to the chain in either direction.

168,968—October 19, 1875. PROVANCE M. BUTTERMORE. *Improvement in scrapers for coke ovens.*

Claims a scraper for coke ovens having a cast iron blade that tapers, in cross section, from the heel to the point, and that has a flange, on the rear side of the blade, that tapers from the center to the edges, in combination with a wrought iron rod roughened or made crooked on its end.

173,344—February 8, 1876. JOEL F. RICE. *Improvement in apparatus for charging retorts.*

In order to prevent loss of gas, and also cracking of retorts by sudden change of temperature, chargers holding a large quantity of coal, and provided with devices for operating them quickly, have been devised, and to some extent adopted in practice. This invention is an improvement in this class of apparatus; and consists, chiefly, in the arrangement of a plug or stop device and means for locking the same, or holding it stationary, in the frame that supports the tubular reciprocating charger.

177,326—May 16, 1876. WILLIAM FOULIS. *Improvement in machines for charging retorts.*

Claims a combination of parts constituting the mechanism for traversing the scoop and by which the charging apparatus is raised and lowered.

177,327—May 16, 1876. WILLIAM FOULIS. *Improvement in apparatus for drawing retorts.*

Claims the mechanism whereby a hydraulic cylinder may be utilized in traversing the machine continuously in one direction and the rake is operated.

182,132—September 12, 1876. JOEL F. RICE. *Improvement in apparatus for removing coke from retorts.*

This invention consists of a sliding scoop placed on a swiveled support that is carried by a truck, the scoop being forced into the retort under the coke by a winch and withdrawn by the same means.

192,288—June 19, 1877. THOMAS F. ROWLAND. *Improvement in retort charging and discharging apparatus.*

Claims the combination of a meter, a coal charging apparatus having a removable bottom, and a coal discharging apparatus, and an engine carried upon the same frame and adapted to be brought opposite the retort to be discharged.

192,289—June 19, 1877. THOMAS F. ROWLAND. *Improvement in gas retort chargers.*

Claims the combination of a scoop, having a removable bottom with a supporting traveling frame, which carries said scoop, and is itself supported upon two sets of runners or rollers, one set of which travels upon the upper surface of a rail, while the other set travels upon the under surface of a rail.

192,290—June 19, 1877. THOMAS F. ROWLAND. *Improvement in gas raking apparatus.*

Claims a rake and rake handle combined with mechanism, whereby the downward position of the rake upon the bottom of the retort is regulated or altered at any point of its travel, while the rake and rake supporting mechanism advance and retire in the same line, as distinguished from a rake which is laterally adjustable by the lateral movement of its entire supporting mechanism.

192,291—June 19, 1877. THOMAS F. ROWLAND. *Improvement in revolving coal meters.*

Claims the combination of a coal meter and an adjustable chute with mechanism whereby the chute is automatically lowered into the scoop beneath during the passage of the coal and is automatically raised after its discharge, whereby the scoop is enabled to advance into the retort free of the chute.

194,998—September 11, 1877. CHARLES F. DIETERICH. *Improvement in machinery for charging gas retorts.*

Claims a coal transporting car having one or more series of invertible troughs placed one above the other, each trough having capacity for a charge for a single retort, and being constructed to empty its contents into a retort charger when placed thereunder.

199,316—January 15, 1878. ABBOTT Q. ROSS. *Improvement in gas retort chargers.*

This invention consists, first, of a retort charging apparatus embracing, in its construction, a carriage or frame, a bar projecting therefrom and supported thereby, and a divided scoop, pivoted to said bar, and arranged to open at the bottom by the swinging of its parts outward, the whole being designed to carry coal into the retort without depending on the latter for the support of any part of the apparatus, and to permit the withdrawal of the scoop without obstruction from the coal deposited; second, of a certain combination of parts, making up an automatically operating device for opening and closing the scoop at the ends of its longitudinal movement; third, in attaching a swinging plate to the forward end of the bar to which the two parts of the scoop are pivoted, which plate is used to discharge the fuel from open-backed or "through" retorts, and may be operated to rake the fuel from retorts open at the front only.

200,888—March 5, 1878. THOMAS H. BIRCH. *Improvement in charging scoops for gas retorts.*

Claims the series of buckets, pivoted transversely within an open scoop-frame, and having geared or other suitable connection with one or more slide bars or racks.

212,569—February 25, 1879. ABBOTT Q. ROSS. *Improvement in gas retort discharging apparatus.*

Claims an automatic discharging rake constructed to enter a retort, and provided with a longitudinally acting spring, situated between the rake and rake carriage, for the purpose of preventing injury to the rake or the retorts when the rake is forced into the retort and of allowing the rake to yield and slide toward the carriage.

212,570—February 25, 1879. ABBOTT Q. ROSS. *Improvement in charging gas retorts.*

Claims the mode of charging gas retorts, consisting essentially in first separating from the mass of coal a full charge for the retort and then blowing said charge in quickly at one operation by the action of dry steam or compressed air.

212,571—February 25, 1879. ABBOTT Q. ROSS. *Improvement in gas retort dischargers.*

Claims in a retort discharger, the combination of a long longitudinally movable blast pipe with a laterally movable discharge end to enter the retort to a point behind the materials to be discharged therefrom, and deliver the blast directly into said retort, with a steam or compressed air reservoir, a connecting pipe leading from such reservoir, and a controlling cock.

212,572—February 25, 1879. ABBOTT Q. ROSS. *Improvement in gas retort chargers.*

The object of this invention is to provide, for the use of small gas manufactories, a simple and convenient hand truck charger, whereby a full charge of coal can be wheeled to the retort, brought to the proper position, and discharged into the retort by a blast of steam or compressed air; and the invention consists, first, in a combined charger and two-wheel truck provided with blast jets and a connection for a flexible telescopic or jointed pipe for introducing the steam or compressed air; and, secondly, in an agitator, operated in part or in whole by the compressed air or steam, for the purpose of feeding the coal down properly in the charger.

212,573—February 25, 1879. ABBOTT Q. ROSS. *Improvement in gas retort chargers.*

Claims the combined charger, conduit, and blast pipe, in combination with mechanism for raising and lowering them together, whereby the several charges are adjustable to the height of their respective retorts, and delivered into the same without the necessity of recharging the apparatus during the operation.

217,272—July 8, 1879. CHARLES F. DIETERICH. *Improvement in apparatus for removing coke from gas retorts.*

This invention relates to an apparatus for removing coke from gas retorts, specially designed for use in connection with an apparatus for charging gas retorts patented to me on the 11th day of September, 1877.

This invention consists, first, in mounting a series of extensible rakes in a frame having a central screw pivot, which works in a nut or bearing forming part of a wheeled car, whereby when the car bearing the rakes is wheeled to the front of the retorts upon a track suitably situated the rakes may be adjusted by means of the screw pivot to the requisite height, and by other suitable means projected into and withdrawn from the retorts, for the purpose of removing the coke therefrom. The invention consists, secondly, in means whereby the prongs of the rakes may be swung or raised, for the purpose of facilitating their passage to the farther ends of the retorts and lowered, so as to catch the coke when said rakes are to be withdrawn, and also in the specific means employed for effecting the projection and retraction of the rakes. Lastly, the invention consists in means whereby the rakes may be adjusted in height independently of the supporting framework thereof.

218,689—August 19, 1879. FREDERICK A. SABBATON. *Improvement in devices for feeding gas retort furnaces with ignited coke from the retorts.*

This invention consists of a device having combined therein a spout fitting the ordinary feed door, through which solid fuel is introduced into the furnace, a conduit which, when the spout is adjusted to the feed door, will receive hot coke drawn from a retort in the furnace and conduct the coke into the spout, and a passage arranged opposite to the spout, and through which the workmen can use a stoking bar to push the coke from the spout through the feed door and into the furnace, and in the combination with the device composed of the spout, conduit, and stoking passage of a wheeled truck, whereby the whole is rendered conveniently portable and readily adjustable to the furnace.

222,562—December 9, 1879. ABBOTT Q. ROSS. *Improvement in gas retort chargers.*

Claims in a gas retort charger, a main car or platform, movable back and forth in front of the retorts, a secondary frame or support for the charging hopper, movable in or out toward and from the retorts, a steam-charging hopper or vessel, and means for raising and lowering the same vertically, and a steam receiver and boiler, located on the main car or platform, and connected with the charging vessel by a flexible or jointed pipe.

222,563—December 9, 1879. ABBOTT Q. ROSS. *Improvement in machinery for discharging gas retorts.*

Claims in combination with a reciprocating rake or series of rakes, an automatically adjustable counter balance, in combination with and actuated by the piston rod and connecting mechanism.

222,564—December 9, 1879. ABBOTT Q. ROSS. *Improvement in gas retort discharging apparatus.*

Claims in a gas retort discharger, the combination, with a reciprocating traveler, of two rakes or series of rakes located on opposite sides of the traveler, devices for connecting either of said rakes or series of rakes to the traveler when desired, and devices for connecting either of said rakes or series of rakes to a stationary part of the machine when desired, whereby either of the rakes or series of rakes may be thrown into operation while the rest remain idle and are cooling.

222,565—December 9, 1879. ABBOTT Q. ROSS. *Improvement in discharging apparatus for gas retorts.*

Claims in a gas retort discharger, the combination, with a rake or rakes hinged to a reciprocating traveler, of an adjustable support for said rake or rakes, by which their elevation and depression may be controlled at any part of their stroke, or when the traveler is at rest, at the will of the operator, and with a counter balance for assisting in said elevation and depression.

249,694—November 15, 1881. RICHARD THOMAS. *Coke furnace and apparatus connected therewith.*

Claims the plant for manufacture of coke consisting of elevated furnaces or retorts, provided with doors at both ends, tracks, elevating apparatus, engine, and endless traveling rope.

276 604—April 24, 1883. RICHARD THOMAS. *Coke furnace and apparatus connected therewith.*

This is a device for withdrawal of coke from ovens or furnaces and loading it into cars.

300 463—June 17, 1884. JONATHAN GREEN. *Coke oven.*

Claims in coke oven, the cradle comprising the gas pipe frame, having series of apertures and prongs upon its upper surface, said prongs being adapted to support and retain the coke upon the cradle while being drawn.

314 510—March 24, 1885. GEORGE W. BIERER. *Apparatus for removing coke from ovens.*

Claims in a machine for drawing coke from ovens or kilns, the combination of a frame with a block sliding thereon, and picks or forks provided with means for giving lateral and horizontal motion to the forks or picks, and lever and treadle for raising the ends of the picks or forks as they enter the oven or kiln.

315,595—April 14, 1885. EDMUND J. BOWEN. *Coke oven.*

Claims a coke oven having an inlet opening at one end and an outlet at its opposite end and having its floor inclined downward toward its discharge or outlet end and provided on such floor with a longitudinal series of rails arranged side by side and a slight distance apart.

322,128—July 14, 1885. THOMAS F. ROWLAND. *Machinery for charging retorts.*

Claims in combination, in a retort charging machine, a scoop provided with a sliding bottom, a hydraulic apparatus for projecting and withdrawing the scoop, consisting of a cylinder attached to the scoop and moving on a fixed piston, and a like hydraulic apparatus for projecting and withdrawing the bottom of the scoop.

362,130—May 3, 1887. FREDERIC C. WEIR. *Machine for pulling coke from ovens.*

This invention comprises driving devices operated by an engine, preferably mounted upon a car, which can be run up in front of the oven, and a windlass operating a reciprocating arm carrying the pulling claws, with suitable mechanism for stopping, starting, tilting, and operating the reciprocating claw-arm.

365.489—June 28, 1887. JULIUS QUAGLIO. *Apparatus for compressing coal and introducing the same into coke ovens.*

Claims the combination, with a carriage, of a chest for receiving and pressing coal, a sliding bottom plate in the chest, a coke case on the carriage, a hinged bottom on the coke case, an engine on the carriage, and a windlass opposite one end of the chest for receiving the coal, which windlass is operated from the engine.

376,531—January 17, 1888. AUGUST LENTZ. *Device for charging retorts.*

Claims the feeding mechanism for retorts, consisting of the curved feeding tube provided with a feed hopper, the wheeled shaft for carrying said tube, and a chain, for raising and lowering said tube.

406.409—July 2, 1889. JAMES H. WALKER. *Retort charging device.*

Claims in a retort charging machine, the combination of a carriage, a frame fixed thereon, a fluid pressure cylinder secured to the frame and having a piston and rod connected to a frame fitted to move vertically in the fixed frame, a series of tilting chutes, each supported adjacent to opposite ends upon the fixed and the movable frames, respectively, and stops fixed to the chutes in position to abut against their supports and regulate their degree of horizontal traverse thereon.

423,924—March 25, 1890. ISAAC B. HAMMOND. *Feeding device for ore roasting furnaces.*

Claims as an appliance for an ore furnace, an ore-feeder consisting of a hopper to contain the ore to be roasted, a revoluble fluted cylinder located at the bottom of the hopper and above the furnace floor and adapted to discharge thereon regulated amounts of ore at regulated intervals, and pawl and ratchet mechanism for revolving the cylinder at regulated intervals to a regulated extent, in combination with a reciprocating rake and a connection between said reciprocating rake and the pawl of the pawl and ratchet mechanism, whereby the cylinder is caused to revolve.

425,797—April 15, 1890. CHARLES W. HUNT. *Car for coke.*

Claims the combination, with the iron car for coke or similar incandescent or hot materials, of perforated pipes around the interior of such car near the upper part thereof, and coupling connections for a water supply, whereby the metallic car is protected from injury by a stratum of water caused to pass over its interior surface.

428,466—May 20, 1890. WILLIAM H. DINSMORE. *Device for removing coke from ovens.*

Claims the device, consisting of a frame having the downwardly and rearwardly inclined notches, a transverse rod having its ends seated in said notches, a chain pendent from said rod and movable thereon, a pulley block swiveled to the lower end of said chain, so as to turn freely in any direction, said pulley block having mounted therein a pulley wheel, and a clearing rod fitting in the groove of said wheel and guided thereby, said rod provided on its outer end with a hand piece or ring and on its inner end with an angularly bent scraping blade.

435,891—September 2, 1890. NATHANIEL O. GOLDSMITH. *Coke drawing machine.*

Claims in a coke drawing machine, the combination, with a platform car, of an engine and a swiveled table mounted on the platform, a reciprocating rake supported by the table and having a rack, an engine shaft geared to one of the car axles, a counter shaft rotated by the engine shaft and geared to the rack on the rake, clutch devices for throwing the engine shaft into and out of gear with the car wheel and the counter shaft, and rack and pinion mechanism actuated by the engine for turning the table.

446,936—February 24, 1891. THOMAS SMITH. *Apparatus for extracting coke from ovens.*

These improvements provide first, means for forcing a plate through the door of the oven and under the coke and for then withdrawing the said plate, bringing with it the coke which is to be extracted; second, enable the said plate to be directed to all parts of the oven in succession, so as to withdraw the whole of the coke; third, provide guides for the bar carrying the said plate and for allowing it to be moved horizontally in any direction, and, fourth, provide means for propelling the entire machine along rails in either direction.

447,022—February 24, 1891. GASTON A. BRONDER. *Gas retort discharging apparatus.*

Claims in an apparatus for discharging gas retorts, the combination, with a track, of a carriage mounted on the track and an extensible and contractible rake composed of two parts, each provided with a rake head, one of the parts having a longitudinally sliding engagement with the other part, said parts being controlled in their movements by the movement of the carriage.

448,636—March 24, 1891. ALVA C. COCHRAN. *Coke oven plant.*

Claims in a coke oven plant, the combination, with a series or line of coke ovens having discharging doors, of a platform in front of the doors and about at the level thereof, a subway beneath the platform, and a chute leading in a downwardly inclined direction through the platform to a car in the subway.

456,140—July 21, 1891. JAMES ELLIOTT. *Apparatus for the manufacture of coal gas.*

Claims in a gas producing apparatus, the combination of retorts provided at their front ends with hoppers connected to a mouthpiece by a pipe and at their rear ends with a mouthpiece, with ascension-pipe hole, and opening, corresponding with openings of a cylinder, pivoted to arms, and chargers placed into said retorts and attached to a rod, passing through lids of retorts attached to toothed wheels, acted upon by worm wheels, secured to shafting.

456,569—July 28, 1891. ANDREW HICKENLOOPER. *Gas retort charger.*

Claims in a retort charger, a carriage adjustable to and from the face of the retort bench, two or more fixed charging hoppers arranged in vertical succession with discharge nozzles in a common vertical plane adapted to enter the mouths of two or more retorts simultaneously, a blast distributer to each hopper at the rear of the discharge nozzle, a standpipe upon said carriage having an extensible connection with a reservoir of blast force, and connections between said standpipe and blast distributers.

469,180—February 16, 1892. GEORGE R. WAITE. *Gas apparatus.*

Claims in a gas apparatus, the combination of a bench having retorts, removable cartridges for such retorts, each having a socket or sockets, the elevated track, the trolley confined on such track, the depending rod at its upper end, pivotally united to the trolley frame, and the cartridge-supporting lever between its ends hung from the lower end of such rod.

469,868—March 1, 1892. THOMAS R. OSBOURN. *Apparatus for quenching coke.*

Claims an apparatus for quenching coke by steam, consisting of a closed car, chamber, or other receptacle, adapted to contain coke, provided with a second or external wall which forms with the wall of the receptacle a closed water containing compartment or jacket to receive the heat radiated from the coke, a water supply discharging into said water containing compartment, and steam outlets leading from the upper portion of said water containing compartment and discharging into the coke receptacle.

475,540—May 24, 1892. ANDRÉ COZE. *Apparatus for discharging gas retorts.*

Claims in combination with a suitable traveling carriage and rake and handle consisting of a flexible band or rod adapted to be curved upward, guide rollers for guiding the handle in a vertical direction, and mechanism for propelling such rake and handle into and out of the retort.

476,685—June 7, 1892. JOHN RUSCOE. *Apparatus for charging gas retorts.*

Claims the combination of main frame, scoop-carrying frame movable vertically in the main frame, horizontal driving shaft, connections between the driving shaft and the movable frame for raising and lowering the latter, a vertical shaft and clutch-actuated gearing between the same and the driving shaft, a worm gear on the movable frame, connections between said gear and the scoop for actuating the latter, and a sliding worm on the vertical shaft for actuating the worm gear.

476,686—June 7, 1892. JOHN RUSCOE. *Apparatus for drawing gas retorts.*

Claims in an apparatus for drawing gas retorts, a main frame, a second frame, supported in the main frame, and a rake arranged to slide longitudinally on the second frame, in combination with a chain, connected to the rake, the chain-carrying pulleys, and the worm gear and pinions for driving the same, all mounted on the second frame, the vertical driving shaft, the worm splined on said shaft and capable of sliding up and down thereon, and means for raising and lowering the second frame.

498,755—June 6, 1893. WILLIAM ARROL AND WILLIAM FOULIS. *Apparatus for charging gas retorts.*

Claims in an apparatus for charging gas and other retorts the combination with a frame and a bar pivoted thereon, of a rod mounted on said pivoted bar for tilting the bar and means for reciprocating the rod so connected as to be operated simultaneously by the movement of a suitable actuating device.

498,779—June 6, 1893. WILLIAM FOULIS. *Apparatus for stirring and drawing gas retorts.*

In carrying out this invention mount on the top side of the I iron or steel bar an iron or steel plate, which has also mounted at its under side two stiffening angle iron or steel bars, which may extend the whole length of the plate or not as desired. The said I iron or steel bar has the slipper or carriage mounted on its lower side in such a manner as to enable it to be reciprocated backward and forward by the two horizontal acting hydraulic cylinders and rams as hitherto, but which, in this case, are mounted on the top side of the plate which is formed with two longitudinal slots or openings, through which the pulleys on the ends of the rams work. The said slots also act as guides for the front ends of the said rams which are formed with suitably shaped guide or slipper blocks. Also provide the front end of the raising and lowering cylinder's ram with a guide or slipper block which works on the upright standard of the apparatus, which as well as the plate has wooden or other buffers attached so as to terminate the strokes of the rams and slipper or carriage. Near the front end of the I or steel bar mount preferably a hardened steel block in such a manner as to guide the rake rod or it may be stirrer rod or rods, during their backward and forward movements. Also so shape the race of the automatic drop plate, that when the apparatus is not in use the plate will be nearly in a horizontal plane and so permit of vehicles and such like passing underneath the front end of the apparatus.

534,422—February 19, 1895. GASTON A. BRONDER. *Gas retort charging apparatus.*

Claims the combination in a retort charging apparatus, of a main carriage for running along in front of the retorts, a scoop carriage arranged to run transversely upon the first-mentioned carriage and having two or more scoop supports, scoops upon said supports, and locking devices for locking each scoop either to the scoop carriage or to the main carriage that it may either move with the scoop carriage or leave the latter free to move without it.

563,781—July 14, 1896. JOHN A. MONTGOMERY. *Combined coke drawing, cleaning, sprinkling, and loading machine.*

Claims in a machine for drawing coke from ovens, the reciprocating and laterally moving coke-drawing frame provided with the endless conveyor, the coke-drawing breaker or shovel, the vertical saws, and the vertical and horizontal fingers and their supporting frame, and the racks on the coke-drawing frame, in combination with a frame having a rotary turntable provided with an engine having a drive shaft and pinions thereon which engage the said racks by means of which the coke drawer is reciprocated, and the sprocket wheels to engage and operate the conveyor.

595,039—December 7, 1897. GASTON A. BRONDER. *Machinery for discharging gas retorts.*

Claims in a machine for discharging gas retorts, the combination of a carriage, two or more rakes, a carrier for said rakes and means for moving said carrier backward and forward on said carriage, a lifting bar on said carriage common to the several rakes, a counterbalance lever from which said lifting bar is suspended and the fulcrum of which is movable, mechanism for moving the said fulcrum, means for connecting said rakes with the said carrier and carriage whereby one or more of them may be moved with the carrier while the other or others are held stationary on the carriage and a detachable connection between the fulcrum-moving mechanism and the carrier-moving mechanism.

621,663—March 21, 1899. JOHN A. HEBB. *Coke drawer.*

Claims in a coke drawer, the combination of a rotatable table, an actuating lever and dogs for operating said table and supported thereby, a segmental rack bar engaged by said dogs, a vertically adjustable reciprocating scraper supported by said table, and mechanism carried by said table for operating said scraper.

643,633—February 20, 1900. ANDRÉ COZE. *Apparatus for charging inclined gas retorts.*

Claims in the automatic system for charging inclined retorts, the combination with a charging hopper, of a valve controlling the outlet of said hopper, means for operating said valve, a spring-supported bucket and mechanism for establishing a connection between said valve-operating means and the bucket, whereby the compression of the springs and the descent of the bucket under the load will effect the automatic closure of the delivery valve of the supply hopper when the bucket has received a load sufficient for the charging of the retort.

644,053—February 27, 1900. ALEXANDER E. BROWN. *Coke pusher.*

Claims in an apparatus for charging or drawing coke ovens, open hearth or steel heating furnaces and the like, the combination of a frame or supporting structure, and a pusher bar or ram composed of sectional members, one of which members rests and is movable horizontally upon said frame or supporting structure, upon or against rollers or similar rotating supports or bearings provided for the purpose, and the other of which members rests upon the first named of said members, upon or against like rollers or rotating supports or bearings; sheaves or similar appliances, at the rear and forward portions respectively of said first named member, and chains, or like devices, fastened to the rear portion of said second named member, and, respectively, to the rear and forward portions of said frame or structure, which chains, in one case, pass over said sheave or sheaves at said rear portion, and, in the other case, pass over said sheave or sheaves at said forward portion of said first named member, together with suitable means for actuating said first named member horizontally forward and back on said frame or supporting structure.

646,820—April 3, 1900. WILLIAM FOULIS. *Apparatus for charging retorts.*

Claims in apparatus for charging retorts and for drawing the charges thereof, the combination, with a guide or beam, a rod carrying a charge pushing or withdrawing device, longitudinally movable on the guide or beam, and motor mechanism such as hydraulic cylinders and rams for imparting such movement to the rod, of motor mechanism for raising and lowering the said rod independently of the guide or beam.

647,347—April 10, 1900. SAMUEL T. WELLMAN, CHARLES H. WELLMAN, AND JOHN W. SEAVER. *Pusher for coke ovens.*

Claims a coke-oven pusher having a stem composed of sections adapted to slide telescopically one within another, the innermost section carrying the pusher, and connections whereby the movement of an inner section is imparted to the section surrounding it, in combination with a chain connected to the innermost section of said stem, and composed of flat elongated links, a sprocket wheel for actuating said chain, and provision for rotating said sprocket wheel.

663,213—December 4, 1900. GASTON A. BRONDER. *Machinery for discharging gas retorts.*

Claims in a machine for discharging gas retorts, the combination, with a carriage and a rake carrier arranged to run therein, of a motor cylinder and a fixed rack and a flying rack all on said carriage, a gear carried by the piston rod of said motor cylinder and engaging with both of said racks, sheaves pivotally attached to said carriage, sheaves pivotally attached to said flying rack, and a rope connected at two points with said carriage and also connected with the rake carrier and running on said several sheaves.

668,234—February 19, 1901. MAXIMILLIAN M. SUPPES. *Apparatus for use in the manufacture of coke.*

Claims the combination of a coke oven having a coke making chamber therein, a vessel of substantially the same internal section as that of said chamber, a recess in the foundation wall at one end of the said oven, a flange at one end of said vessel adapted to enter said recess, a projection from a central portion of said vessel, and a fixed stop adapted to be engaged by said projection.

669,377—March 5, 1901. ADDISON M. BACON. *Coke drawing apparatus.*

Claims a coke drawing apparatus comprising a fixed support, a supplemental support on which the apparatus may be moved, means for moving one of the said supports vertically, a hollow drawing tool adapted to be projected and retracted on said support, and means for passing a stream of water to said tool.

676,025—June 11, 1901. GASTON A. BRONDER. *Gas retort charging apparatus.*

Claims in a retort charging apparatus, the combination of a main carriage, a hopper mounted on the same, a scoop carriage operating on the main carriage, coal scoops carried on the scoop carriage, scraper frames with scrapers actuating in the scoops, locking bar support angles secured to the uprights of the main carriage and to the hopper, locking bars fulcrumed to the locking bar support angles for detaining the scrapers in the retorts, tipping cams secured to the horizontal braces of the scoop carriage for unlocking the locking bars, adjusting cams attached to the locking bar support angles, friction and adjusting rollers secured to the scoops actuated by the adjusting cams to obtain the proper positions for the scoops to enter the retorts.

682,793—September 17, 1901. EDWARD DRORY. *Means for charging gas retorts.*

Claims the combination with sets of furnaces arranged to have a clear space between, separate roofs for each set of furnaces, structural ironwork supporting the ends of the roofs and connected above the ground to leave a free passage between the buildings, two sets of cantalevers projecting into each building, coal receptacles above and proximate, the furnace fronts supported on the upper sets of cantalevers, discharging hoppers on said receptacles, a track supported by the upper set of cantalevers, a charging vessel arranged to move on said track, and a platform beneath the coal receptacles supported by the lower sets of cantalevers.

687,600—November 26, 1901. GASTON A. BRONDER. *Coal hopper for gas retort chargers.*

Claims a hopper, pushers extending between the sides of the hopper, consisting of a plate curved approximately at right angles, sliding brackets supporting the said curved plate, brackets fastened to the plates, links pinned to the brackets; in combination with cross shafts, cranks fastened to said shafts, links connecting the cranks and the brackets fastened to the pushers, levers fastened to the cross shafts, handle bars pinned to the levers.

691,148—January 14, 1902. WALTER KENNEDY. *Plant for coke making.*

Claims in an apparatus for manufacture of coke, the combination of two lines of hearths, two series of two or more ovens movably arranged on the hearths, a car movable between the lines of hearths, a bridge movably mounted on rails parallel with the hearths, a buggy movably mounted on the bridge, and hoisting mechanism arranged on the buggy and adapted to be connected to the ovens in turn.

692,746—February 4, 1902. SAMUEL T. WELLMAN, CHARLES H. WELLMAN, AND JOHN W. SEAVER. *Combined charging and discharging device for coke ovens.*

Claims a coke oven or retort charging machine having a movable coal carrier whereby the charge of coal is carried into the oven or retort, and a pusher combined with said coal carrier, whereby the charge of coke may be pushed from the oven at the same time that the fresh charge of coal is being introduced into the same.

695,970—March 25, 1902. EDWARD N. TRUMP. *Coke handling apparatus.*

Claims the combination, with an oven, of a device for discharging the body of coke in a substantially horizontal plane from the oven, and means provided with a platform of a length greater than the width of the body of coke for receiving and retaining the coke, said means being movable for moving the platform crosswise of the path of the body of coke during the discharge of said body of coke, and cooperating with said device for causing the advancing end portions of the body of coke to become detached therefrom in masses which are caused to tumble or fall from the advancing body of coke successively directly upon the platform, and to become distributed on said platform in a broken condition and in a layer of substantially uniform thickness extending crosswise of the path of the body of coke.

705,656—July 29, 1902. EDWARD DRORY. *Means for charging gas retorts.*

Claims the combination, with furnaces arranged to have a clear space between them, independent roof structures, posts to support the roof structures, beams connecting the posts supporting the independent roof structures and coal bins supported on said beams within the free space between the roof structures.

707,379—August 19, 1902. LÉON BERTRAND. *Apparatus for quenching or cooling coke.*

Claims, in an apparatus for quenching or cooling coke, the combination, with a tank provided with a closed casing, of a hopper suitably attached to said tank, means in the casing of said tank for continuously discharging coke, means in said tank for submerging all the coke fed thereinto, and means in said tank for carrying off the fluid generated by the coke while being immersed in the liquid contained in said tank.

707,525—August 19, 1902. JOHN WRIGHT SEAVER. *Process of manufacturing coke.*

Claims the process of manufacturing coke, consisting in assembling the charge to be coked, assembling the charge and the dome, moving the assembled charge and dome onto a fixed hearth, and coking the charge.

707,686—August 26, 1902. DAVID FERGUSON. *Coke drawer.*

Claims, in a coke drawer, a frame, a drum mounted therein, a reach rod, a flexible device operatively connecting the drum and the rod, a conveyor, disconnectible driving connections between the conveyor and the drum, and means secured to the rod to which power may be applied for driving the rod and the drum when the rod is entering the coke oven.

710,643—October 7, 1902. JOHN F. WILCOX. *Coal ramming and transfer apparatus.*

Claims the combination, in a coking plant, of a ramming station, a plurality of rammers and ramming boxes, a series of ovens, a main track for the delivery of charges to the ovens, and auxiliary tracks for the delivery of the ramming boxes to the main track.

713,413—November 11, 1902. ALFRED ERNST. *Charging device for coke ovens.*

Claims the combination, in a charging hopper for coke oven charging machines, of sides movable from and toward each other, a longitudinally movable bottom, and means whereby said longitudinal movement of the bottom is caused to effect expansion or contraction of the sides of the hopper.

713,648—November 18, 1902. HUGH KENNEDY. *Coke oven.*

Claims, in combination with a coking hearth, a platform movable upwardly and downwardly below the level of said hearth, and a coke oven movable transversely to and from the hearth and platform.

715,004—December 2, 1902. LÉON BERTRAND. *Apparatus for discharging retorts.*

Claims, in an apparatus for discharging coke from gas retorts, a plurality of extensible sections, operating means for advancing one of said sections, means for locking said section to the next succeeding section, means for releasing said operating means; and operating means acting upon the last-mentioned section for advancing both of said sections.

716,201—December 16, 1902. JOSEPH DE BROUWER. *Apparatus for charging retorts.*

Claims a projecting apparatus for charging coal into retorts, comprising a rotary projector, an endless belt, a frame carrying them, said frame being adapted to be oscillated to vary the trajectory of the projected coal.

717,334—December 30, 1902. GASTON A. BRONDER. *Gas retort charging apparatus.*

Claims, in a retort charging apparatus, the combination of a scoop, a plow on the scoop, a scraper frame arranged to slide on the scoop, scrapers extending from the said frame and into the scoop, openings in the scrapers, covers over the said openings arranged to open the said openings by the plows bearing therein.

717,440—December 30, 1902. GEORGE H. McCRACKEN. *Unloading mechanism for coke ovens.*

Claims the combination, with a coke oven, of a rotatable bottom therefor, a car movable at the side of the oven, mechanism interposed between the car and rotatable bottom for imparting movement to the latter, and means located on the car whereby the interposed mechanism is operated to rotate the rotatable bottom.

717,575—January 6, 1903. WALTER RALPH HERRING. *Apparatus for charging inclined retorts.*

Claims, in apparatus for charging retorts, the combination, with a chute having guide rails at its lower part, of a hood slidable on the said rails longitudinally of the retorts, an inclined shoe, links pivoting the lower part of the said shoe to the said hood, and means for adjusting the position of the upper end portion of the shoe within the said hood.

720,065—February 10, 1903. IRWIN W. PIKE. *Apparatus for cooling coke, etc.*

Claims, in an apparatus of the character recited, the combination of a water-containing tank, a trackway leading into and out of the same, a truck upon said trackway, a hood closed except at the bottom and enclosing the top sides and ends of said truck, and having its lower end beneath the surface of the water in said tank, together with means for flowing water over said hood.

721,519—February 24, 1903. WILLIAM S. JONES AND JOHN P. DONOHOE. *Coke drawer.*

Claims a mechanical means for drawing coke, comprising a main frame, a support for the operator, movable on the main frame to and from the oven, a scraper holder mounted on said support and adapted to pull the scraper out with it as the support is moved away from the oven.

721,952—March 3, 1903. WALTER RALPH HERRING. *Gas retort discharging apparatus.*

Claims an apparatus for use in discharging inclined gas retorts, and comprising a carriage mounted on wheels, a body erected or suspended thereon having a vertical chute and an inclined chute, a flap hinged upon a shaft within said body so as to control the inlet to said chutes, means for operating said flap, a swing box carried upon a shaft within said vertical chute and having an extended central partition whereby the direction of discharge from the vertical chute may be regulated, means for adjusting the position of said swing box, a tar screen, and a rail carried by supports.

722,599—March 10, 1903. BURTON J. MATTESON. *Coke drawing machine.*

Claims, in a machine of the class described, a laterally movable drawbar, a shaft, mechanism for oppositely rotating said shaft, a spherical portion fixed to said shaft, and a power transmitting member for actuating said drawbar, having a spherical seat to receive said spherical portion, and rotative with the latter.

723,479—March 24, 1903. EDWIN A. MOORE. *Coke pusher.*

Claims a coke pusher having an extensible jib pivotally secured at its lower end to the frame of a car, and provided with revoluble carriers, in combination with a pusher bar supported by said jib and carriers, and provided with means for projecting and retracting the jib.

723,493—March 24, 1903. FREDERIC W. C. SCHNIEWIND. *Double coke pusher.*

Claims a coke pusher provided with two opposite balancing pusher bars, means for supporting said bars, and a separate motor for each bar, whereby the bars may be reciprocated simultaneously or independently of each other; in combination with two opposite ovens.

725,750—April 21, 1903. EDWIN A. MOORE. *Construction of coke ovens.*

Claims a coke oven having rails on each side thereof, in combination with a coal charging car having laterally movable wheels engaging said rails.

727,790—May 12, 1903. JOHN A. HEBB. *Coke drawing machine.*

Claims, in apparatus for drawing coke, the combination with a reciprocating beam, of a pivotally attached rake adapted to be folded backwardly by contact with the coke, a spring device located remotely from the rake, and connections between the spring device and rake by which the rake is extended.

727,942—May 12, 1903. JOHN A. HEBB. *Coke drawing machine.*

Claims, in a coke drawing machine, the combination of a main framework provided with supporting wheels, a main driving shaft, a countershaft at right angles thereto, a central vertical shaft, gearing by which motion is transmitted from the main shaft to the countershaft and vertical shaft, respectively, a turntable mounted on the upper framework, a reciprocating beam provided with a rake head, means for transmitting reciprocating motion to the beam from the vertical shaft, means for raising and lowering the end of the beam, means for rotating the turntable, and means for moving the framework along the track.

727,943—May 12, 1903. JOHN A. HEBB. *Coke drawing machine.*

Claims, in apparatus for drawing coke, the combination, with a reciprocating beam, of a pivotally attached scraper adapted to be folded backwardly by contact with the coke, a counterweighted lever pivoted to the beam, and a connection between said counterweighted lever and the scraper by which the scraper is extended.

728,101—May 12, 1903. JOHN A. HEBB. *Coke drawing machine.*

Claims, in a coke drawing machine, mechanism for transmitting longitudinal movement to the beam, consisting of a driving shaft, a driving pinion secured to the shaft, bevel wheels loosely journaled on the shaft and provided with clutch portions, clutch devices in spline engagement with the shaft adapted to engage said portions, and means for driving the toothed wheels in opposite directions.

728,102—May 12, 1903. JOHN A. HEBB. *Coke drawing machine.*

Claims, in a coke drawing machine, mechanism for raising and lowering the beam, consisting of a crank, arms connected therewith, and provided with means for engagement with the beam, a shaft, and gearing for imparting movement to the crank arm and beam in either direction.

728,168—May 12, 1903. JOHN A. HEBB. *Conveying mechanism for coke drawing machines.*

Claims, in combination with a coke drawing machine provided with a longitudinally movable rake; a transversely arranged receiving conveyor, an independent delivery conveyor at an angle thereto, and means for driving both conveyors.

729,259—May 26, 1903. LÉON BERTRAND. *Apparatus for charging retorts.*

Claims the combination of a motor; a charging device operated by said motor; a feed device adjacent to said charging device; and means, thrown into operation by said feed device, for reducing the speed of said motor.

731,251—June 16, 1903. CHARLES H. WELLMAN, ALFRED ERNST, AND FREDELLIA H. MOYER. *Combined charging and discharging device for coke ovens.*

Claims the combination of the movable hopper bottom of a coke oven charging machine, with a pusher plate and one or more brace bars therefor, both the plate and its brace bar or bars being pivotally mounted upon the forward end of said hopper bottom whereby they can be swung into horizontal position for withdrawal beneath the charge of coal in the oven.

731,252—June 16, 1903. CHARLES H. WELLMAN AND ALFRED ERNST. *Apparatus for pushing coke from coke ovens.*

Claims the combination, in a coke oven pusher, of a double ended pusher bar, a structure upon which said bar is mounted so as to be projected from either side of the machine, and means for imparting longitudinal movement to the bar.

731,374—June 16, 1903. JAMES B. LADD. *Coal compressing device.*

Claims, in a coal compressing device, the combination of a receptacle comprising a movable bottom, a hinged front end, a removable back end, a hinged top, and means for locking said parts in fixed relative position, laterally movable sides adapted to have a forward contracting and receding movement, means whereby said forward movement of the sides is imparted to the members above recited, and means whereby the forward movement of the sides is caused.

731,911—June 23, 1903. JAMES ELLWOOD JONES. *Machine for discharging coke ovens.*

Claims a coke puller comprising an underworking wedge-like scraper, movable over the bottom of a coke oven and operative on its instroke to loosen coke for withdrawal, and means adjustable after the instroke to engage and hold loosened coke.

731,912—June 23, 1903. JAMES ELLWOOD JONES. *Mechanism for discharging coke ovens.*

Claims in a coke puller the combination of an underworking scraper movable over the bottom of a coke oven and provided with means for loosening the mass of coke under which it passes on the instroke from the caked mass of coke within the oven, and an overworking claw connected therewith and adapted to close over said scraper for grasping the loosened coke on the outstroke.

731,913—June 23, 1903. JAMES ELLWOOD JONES. *Machine for discharging coke ovens.*

Claims in a coke puller the combination of an underworking wedge-like scraper movable over the bottom of a coke oven and adapted on its instroke to loosen coke for withdrawal, a swinging coke grasper hinged to said scraper and means connected with the underside of said grasper for adjusting it into holding position on the outstroke.

733,036—July 7, 1903. PHILIP B. HASBROUCK. *Coke oven operating apparatus.*

Claims a coke oven operating apparatus comprising a movable supporting structure, a pusher or ram carried on said structure, screw shafts, means for actuating the screw shafts, means mounted on the screw shafts arranged to travel thereon, said pusher or ram flexibly connected with said latter means.

742,037—October 20, 1903. WILLIAM KERNS. *Coke drawer.*

Claims a device comprising in combination a frame or casing designed to be extended into a coke oven, means for gradually advancing the same, an endless conveyor, an incline extending from the end of the frame, a clawer for forcing the coke up such incline, and means for actuating such clawer.

746,056—December 8, 1903. DAVID FERGUSON. *Coke drawer.*

Claims in a mechanical rake or drawer a drawer bar, a rake carried thereby and having movement transversely thereof, means connected to said rake and to said bar which initially causes the rake to travel transversely of the bar and when the travel of the rake has reached a limit causes the bar with the attached rake to travel longitudinally.

747,172—December 15, 1903. JOHN HAUG. *Apparatus for compressing and charging coal into coke ovens.*

Claims in a device means for compressing the coal and means for forming depressions on the lower side of the cake of compressed coal.

749,058—January 5, 1904. JOHN A. HEBB. *Coke drawing machine.*

Claims in a coke drawing machine the combination with a longitudinally movable beam provided with a scraper, of screw mechanism for raising and depressing the beam.

752,904—February 23, 1904. CHARLES WALLACE HUNT. *Apparatus for handling coke.*

Claims the combination of a bench of retorts, a floor having an opening through which the coke discharged from the retorts may fall, means to quench the coke as it falls through said opening, a chamber beneath said opening, and an exhaust device connected to said chamber to withdraw the steam from said chamber as the coke is quenched

753,142—February 23, 1904. JOSEPH KERSHGENS. *Machine for discharging coke from ovens.*

Claims in a machine for discharging coke from ovens the combination with a supporting frame, of a push bar arranged for reciprocation on said frame and adapted to be projected from the side of the frame, means for projecting said push bar normally disengaged from the push bar, and separate means for imparting initial movement to the push bar to bring it into engagement with said projecting means.

754,233—March 8, 1904. SAMUEL T. WELLMAN, CHARLES H. WELLMAN, JOHN W. SEAVER, AND THOMAS R. MORGAN. *Machine for charging coke ovens.*

Claims in a coke oven charging machine a hopper with sides adjustable from and toward each other, slides carrying an adjustable side of the hopper and laterally adjustable upon the frame of the machine, and means for effecting simultaneous adjustment of all of said slides.

755,154—March 22, 1904. EDWIN A. MOORE. *Coke quenching and bleaching apparatus.*

Claims a coke quenching and bleaching apparatus, consisting of a receptacle provided with laterally movable doors at both its ends, means for supplying water thereto, an outlet for water at the bottom and at one end of the receptacle, an outlet for steam, and means for controlling said outlet.

756,225—April 5, 1904. WALTER WILLIAM FIDDES. *Gas retort charger and discharger.*

Claims a discharging charger for drawing and charging gas retorts consisting of the two side plates, distance pieces between the two side plates near their tops, and division plates pivoted between the two side plates and free to swing forward toward the front of the charger, and a bed plate on which the parts rest.

756,696—April 5, 1904. ADOLF PFEIFFER. *Apparatus for feeding gas retorts.*

Claims the combination with two parallel revolubly mounted feed tubes provided with discharge openings, and means for rotating the tubes in opposite directions to bring their openings into filling and discharging position, of two revolubly mounted valves, suspended between the upper sides of the tubes in register with their openings, whereby the valves will lie close together when the tubes are filled but will separate and overlie the closed sides of the tubes when they are discharging their contents.

757,283—April 12, 1904. ANDREW JACKSON DOSS. *Coke puller.*

Claims a coke puller comprising an underworking wedge-like hollow scraper provided with an opening in its upper part and with a hollow shank, an actuating bar extending through said hollow shank into said hollow scraper, and an adjustable coke holder consisting of a plate hinged to said bar and thrust into operative position through said opening.

757,312—April 12, 1904. JAMES ELLWOOD JONES. *Coke puller.*

Claims a coke puller comprising an underworking wedge-like scraper movable over the bottom of a coke oven, an adjustable coke holder hinged to said scraper and provided with a crank arm, a lever engaging said crank arm, and an actuating rod connected with said lever for swinging said coke holder into operative position.

761,251—May 31, 1904. CHARLES S. PRICE. *Coke quenching apparatus.*

Claims the combination with a retort coke oven, of a quenching apparatus consisting of a covered receptacle of considerably greater width than the coke oven, said apparatus being provided with a door opening adapted to register with that of the coke oven, a series of water spray pipes mounted within the upper portion of said receptacle, and means for supplying and regulating the flow of water therethrough.

765,809—July 26, 1904. GASTON A. BRONDER. *Gas retort charging apparatus.*

Claims in a scoop of a retort charging apparatus the combination of a scraper frame with scrapers arranged to slide on the scoop, covers arranged to rise, lower and swing on the scrapers, a plow with rising and horizontally diverging sides on the scoop, and arranged to pass under the scrapers.

768,067—August 23, 1904. WILLIAM H. McCONNELL. *Coke extractor.*

Claims in a coke extractor the combination of a ram carriage arranged to rotate on suitable rollers on the bed plate of the machine; a suitable bearing attached to the bed plate around which the carriage rotates, a driving shaft passing through and rotating in said bearing, a ram sliding in the carriage actuated by the rotation of the shaft; suitable vertical guiding rollers in the carriage for guiding the horizontal movement of the ram in the carriage; horizontal rollers at either end of the carriage for guiding the vertical movement of the ram; and devices substantially as described whereby the ram carriage and ram are rotated on the bed plate.

774,330—November 8, 1904. EDWIN A. MOORE. *Coke quenching and bleaching apparatus.*

Claims a receptacle for hot coke and means for supplying water thereto; in combination with means for collecting and condensing steam generated in treating the coke.

775,177—November 15, 1904. JAMES ELLWOOD JONES AND HARRY KING. *Coke puller.*

Claims a coke puller comprising an underworking wedge-like scraper movable over the bottom of a coke oven, a plurality of coke holders connected therewith and adjustable after the instroke to enlarge the capacity of the scraper on the outstroke, and means for adjusting said coke holders.

775,178—November 15, 1904. JAMES ELLWOOD JONES AND HARRY KING. *Coke puller.*

Claims a coke puller comprising an underworking wedge-like scraper movable over the bottom of a coke oven and provided with a slot or opening, an adjustable arc shaped coke holder disposed within said scraper, and means for thrusting said arc shaped coke holder outward into operative position to hold coke on the outstroke.

775,179—November 15, 1904. JAMES ELLWOOD JONES. *Coke puller.*

Claims a coke puller comprising an underworking scraper, a coke holder comprising a swinging plate hinged to said scraper and provided with a toothed segment, an actuating rack bar and a pinion connecting said rack bar with said segment.

775,108—November 15, 1904. JAMES ELLWOOD JONES. *Coke puller.*

Claims a coke puller comprising a frame and a plurality of swinging wedge-like extractors disposed one behind another and adjustable to horizontal position to serve as coke looseners on the instroke and to upright position to serve as coke holders on the outstroke, and means for swinging said extractors into different positions to adapt them to perform their separate functions in succession.

775,182—November 15, 1904. HARRY KING. *Machine for discharging coke ovens.*

Claims in a coke puller the combination of an underworking wedge-like scraper movable over the bottom of a coke oven and adapted on its instroke to loosen coke for withdrawal and on its outstroke to withdraw loosened coke, a swinging coke grasper provided with a rigid arm extending downward therefrom, a slide bar connected with said rigid arm, and another slide bar having a link connection with said rigid arm.

775,183—November 15, 1904. HARRY KING. *Coke puller.*

Claims a coke puller comprising an underworking scraper adapted to operate on its instroke to loosen coke for withdrawal and on its outstroke to withdraw loosened coke, a tilting plate pivoted about midway of its length to the body of said scraper and adapted to serve in a forwardly inclined position as a wedging or lifting surface for said scraper and in the oppositely inclined position as a coke grasper or holder, and means for tilting said plate.

775,196—November 15, 1904. FRANK CHASE SOMES. *Mechanical coke puller.*

Claims a coke puller comprising an underworking scraper adapted to operate on its instroke to loosen coke for withdrawal and on its outstroke to withdraw loosened coke, and a sliding extension plate movable on said scraper and adapted to receive and hold the loosened coke which falls thereon on the outstroke.

775,197—November 15, 1904. FRANK CHASE SOMES. *Coke puller.*

Claims a coke puller comprising an underworking scraper adapted to operate on its instroke to loosen coke for withdrawal and on its outstroke to withdraw loosened coke, a sliding extension plate movable on said scraper and adapted to receive and hold the loosened coke which falls thereon on the outstroke and means under the control of the operator for sliding said plate into extended position to receive coke falling from said scraper on the outstroke.

775,211—November 15, 1904. ANDREW JACKSON DOSS. *Coke oven discharging machine.*

Claims in a coke drawing machine the combination of a track, a coke puller carriage adapted to travel on said track toward and from a coke oven, a coke puller supported on said carriage and adapted to travel therewith to effect the coke pulling operations, means for reciprocating said coke puller carriage, and mechanical means on said carriage and under the control of the operator for otherwise manipulating said coke puller.

775,221—November 15, 1904. HARRY KING. *Coke puller.*

Claims a coke puller comprising an underworking scraper adapted to operate on its instroke to loosen coke for withdrawal and on its outstroke to withdraw loosened coke, a swinging coke grasper hinged to said scraper and provided with a rigid arm extending downward within said scraper from the pivot of said coke grasper, and a slide rod having a pin and slot connection with said rigid arm for swinging it into open and closed position.

775,266—November 15, 1904. ANDREW JACKSON DOSS. *Implement for discharging coke ovens.*

Claims an implement for use in the discharge of a coke oven comprising a coke loosener having a doubly inclined upper face adapted to slide under the coke on the inward and outward strokes and provided with a shank adapted for detachably engaging a handle.

775,275—November 15, 1904. HARRY KING. *Coke puller.*

Claims in a coke puller the combination of a coke puller bar, a coke puller blade having a pivotal connection with said bar and adapted to swing outward approximately in line therewith to form a wedge-like coke loosener or to swing substantially at right angles to said bar to form a claw, and means for swinging said blade into its different positions.

780,203—January 17, 1905. JAMES B. LADD. *Charging device for coke ovens.*

Claims in a coke oven charging machine the combination of a longitudinally movable peel, a threaded shaft rotatably mounted diagonally across the longitudinal extension of the peel, and means connected with the peel for cooperating with the shaft to cause the movement of the peel upon the rotation of the shaft.

783,637—February 28, 1905. JAMES B. LADD. *Coal compressing and charging device.*

Claims in combination with a coal compression box, having a horizontally movable side, independently movable, power operated mechanism for automatically charging said box exactly full at a single operation.

786,623—April 4, 1905. FREDERICK D. BUFFUM. *Machine for drawing coke.*

Claims a coke drawing machine comprising in its construction a shovel having a flat bottom and mounted so as to be rotated or oscillated on an axis extending lengthwise of said shovel, means for reciprocating the said shovel, and power mechanism for turning it on said axis.

790,326—May 23, 1905. FRED R. STILL. *Coke quenching apparatus.*

Claims in a coke quenching apparatus the combination of a substantially horizontally extending receptacle having formed lengthwise therein a series of fill openings and a corresponding number of discharge outlets, and a draft conduit communicating with the receptacle and adapted to remove the gases and vapors produced by the receptacle contents.

791,685—June 6, 1905. SAMUEL J. FOWLER. *Apparatus for charging retorts.*

Claims a projecting apparatus comprising a rotary wheel having provisions for admitting material adjacent its axis and ejecting the same at its periphery, an endless belt surrounding a greater portion of said wheel in contact with the periphery thereof and cooperating with said wheel to permit the material to be projected through the space not surrounded by the endless belt.

793,238—June 27, 1905. CARL SCHROETTER. *Discharger for coke ovens.*

Claims a discharger for coke ovens and retorts adapted to remain in the coking chamber during the coking operation and comprising a metal plate equal in width to the oven and bent at substantially right angles to form a horizontal member lying upon the sole of the retort and a vertical member of substantially the height of the charge, a similarly bent bar constituting a reinforcing rib secured to said plate longitudinally and substantially centrally thereof, and a pair of tie rods uniting the free ends of said horizontal and vertical members.

793,355—June 27, 1905. JOSEPH DE BROUWER. *Apparatus for discharging coke.*

Claims an apparatus for pushing coke from through retorts, consisting of a rigid rod-bar, toothed links attached thereto, forming a rack flexible in one direction only, means on which the rack may be folded up, and an operating pinion meshing with said rack.

793,773—July 4, 1905. CHRISTIAN EITLE. *Gas retort charging machine.*

Claims in a machine for filling retorts a centrifugal drum, rotating blades mounted within the drum, a feed orifice, a feed worm in the feed orifice, a storage receptacle, a raising and lowering device, and a deflecting plate.

794,960—July 18, 1905. HERBERT JOHN TOOGOOD. *Charging machine for gas retorts.*

Claims in a retort charger the combination, with a charging chamber provided with an inlet and an outlet, of movable feeding devices arranged in the said chamber, and means for accelerating the motion of the said feeding devices in their passage from the said inlet to the said outlet.

795,202—July 18, 1905. LÉON DEGRAND. *Apparatus for discharging retorts.*

Claims in an apparatus for discharging retorts mechanism for providing a properly-timed operation of the apparatus, the said mechanism consisting of a series of racks, all of which are movable and provided with locking means to couple the same for unitary sliding movement at intervals, said locking means consisting of pins projecting from and openings formed in the several racks, the pins consecutively and loosely engaging the openings of the racks and also operative in part to prevent one rack from being driven by the friction of an adjacent rack before the latter rack is at the end of its stroke.

801,492—October 10, 1905. JOHN WEST. *Gas retort charging machine.*

Claims in a gas retort charging apparatus the combination of a carriage, means to move the same, a ram, the stem of which is provided with a rack, a chain drum, a shaft having parallel wheels mounted thereon over which the chain on said drum operates, a gear mounted on said last mentioned shaft adapted to mesh with a gear mounted upon a shaft in advance of said last mentioned shaft, a cam adapted to operate a clutch mechanism alternately in different directions laterally, in combination with mechanism to prevent the cam shaft operating until the proper time.

803,586—November 7, 1905. JOHN S. HAM. *Coke extractor.*

Claims in a coke extractor the combination of a truck mounted on wheels, a ram carriage arranged to rotate on the truck and a ram or bar arranged to move horizontally therein, the rear end of which is composed of parts joined together so that the ram is rigid at the end toward the coke oven and rigid or flexible at the outer end, as may be desired.

804,670—November 14, 1905. HARRY FRANCIS PEARSON. *Coke puller.*

Claims in a coke puller the combination of a movable support, a turret mounted thereabove, a motor upon said turret, a device for swinging said turret upon said support, and means for connecting said device to said motor.

Subclass 6. Coke Ovens—Doors.

184,473—November 21, 1876. HENRY A. LAUGHLIN. *Improvement in furnace doors.*

A cast iron door body having openings therein, in combination with removable panel plates covering the openings; a series of studded panel plates, in combination with a door body having transverse ribs and openings; a plastic filling, in combination with studded plates and paneled door body; a shoe; in combination with an upright, the two interlocking, and uprights connected at their upper ends by a crossbar, in combination with one or more tie rods passing through the crossbar.

244,528—July 19, 1881. CHRISTOPHER BEAM. *Door for coke ovens.*

Claims in a coke oven a chambered door composed of a lower part, constructed with an exterior perforated wall of iron, having flanges, and an inside sectional wall of fire clay, and upper solid arched part of iron, hinged to the top of the chambered lower part, and adapted to open outwardly in a vertical plane.

253,235—February 7, 1882. WILLIAM H. STRICKLER. *Oven and furnace door.*

Claims in a furnace door, the combination, with a metallic front, of a fire brick back bolted thereto, the said front and back being some distance apart, and the heads of the bolts embedded in the fire brick.

287,285—October 23, 1883. JOHN HERRON AND ROBERT T. WRAY. *Coke oven door and frame therefor.* (*Reissued June 3, 1884, No. 10,484.*)

Claims the combination of door frame, inclosed fire brick, movable iron plate provided with handle, crossbar, and wedge, connected to chain; also a door frame provided with refractory brick filling and an air inlet above the arch or upper bar.

288,761—November 20, 1883. WILLIAM H. BECKWITH. *Coke oven door.*

Claims a coke oven door, consisting of a lower section, for permitting the charge to be withdrawn, and upper section for permitting the charge to be leveled without escaping from the oven, and air inlet doors applied to openings at the top of the upper section, and adapted to be opened and to stand open to a greater or less extent, according to the required supply of air to the oven.

294,845—March 11, 1884. WALTER A. BLYTHE AND JAMES HENDERSON. *Coke oven door.*

Claims the combination of oven, horizontal water pipe arranged above the doorway and connected with a water supply, door provided with a water jacket, connecting pipe depending from the water pipe and arranged to deliver water into the water jacket, and hanger bar journaled at one end on the water pipe and having its other end connected with the door.

300,256—June 10, 1884. JOHN HERRON AND ROBERT T. WRAY. *Door for coke ovens.*

Claims the combination of a frame and brick work built therein, with a double door, which is placed inside of the door frame and which is provided with means for regulating the passage of air up through the door, and a peephole.

307,258—October 28, 1884. WILLIAM H. BECKWITH. *Coke oven door.*

Claims, in combination with an oven door provided with guides and air inlet, a slide having its ends mounted in said guides and provided with a lug and a lever, pivoted to the door, and having an eccentric head bearing against the lug.

307,720—November 4, 1884. JOHN HERRON. *Door for coke ovens.*

Claims a door for coke ovens, composed of two separable sections, each one of which consists of a metallic shell or frame, a filling of fireproof composition, and a wire netting for holding the composition in place, the upper section being provided with depending strips for catching against the face of the lower section.

374,942—December 20, 1887. JOHN J. DAVIS. *Coke oven door.*

Claims the combination, with a coke oven, of a door plate seated removably on the bottom of the discharge opening of the oven and reaching part way the height of said opening, and provided with a top ledge, and a shelf, supported with its inner edge removable on said ledge.

441,083—November 18, 1890. JOHN WATERS. *Furnace door.*

Claims a furnace door, consisting of the combination, with a frame, of a brick having an undercut groove, and a removable fastening device comprising a flange, adapted to fit said groove, and a stud, and means for securing the latter to said frame.

578,510—March 9, 1897. CHARLES WILSON GARLAND. *Door for coke ovens.*

Claims an oven door, comprising the upper and lower pairs of doors hinged at their outer edges and provided with perforations, the lower doors being provided at their upper and lower edges with openings and removable linings detachably interlocked with the doors, forming intervening spaces between them and the doors and provided with openings corresponding with the openings in the doors.

601,468—March 29, 1898. GUSTAV HILGENSTOCK. *Coke oven door.*

Claims a coke oven in combination with a door lined with refractory material and having a combustion chamber formed therein, with passages for the introduction of gas and escape of products of combustion.

725,745—April 21, 1903. EDWIN A. MOORE. *Coke oven door.*

Claims a coke oven door, in combination with a plurality of clamping bars, movable links, a shaft on which the clamping bars are mounted, and a shaft which passes through the movable links, and means on each of said shafts for forcing the door to its seat by revolving the shafts.

725,746—April 21, 1903. EDWIN A. MOORE. *Water-cooled coke oven door.*

A hollow rectangular coke oven door having communicating water chambers therein, and a hollow rectangular door frame provided with water chambers, in combination with a supply pipe, a connection between said pipe and the door, a connection between the supply pipe and the door frame, a discharge pipe, a connection between the discharge pipe and the door, and a connection between said pipe and the door frame.

725,747—April 21, 1903. EDWIN A. MOORE. *Water-cooled coke oven door frame.*

Claims a hollow coke oven door frame provided with partitions extending from the upper end of the frame down through the sides and part way across the lower end toward the transverse center thereof, an intermediate partition in the lower end of the frame, a water supply and a water discharge opening at the upper end and on opposite sides of the transverse center of the frame.

736,281—August 11, 1903. GEORGE D. MACDOUGALL. *Coke oven door.*

Claims in an oven the combination of the door casing having the packing, the buckstays having the inclined or beveled vertical edge flanges, the door having the inturned flange engaging said packing, the exterior rotary latch levers pivoted to the door and having the beveled end rabbets engaging the beveled flanges of said buckstays to press the door flange against said packing.

750,323—January 26, 1904. BIRDINE TROUTMAN. *Coke oven door.*

Claims the combination, with the doors, of a lug formed upon the lower door, and the upper door frame having a recess within which the lug is adapted to be received and lock the lower door, said pin also acting as a fulcrum for the coal leveling implement.

Subclass 7. Coke Ovens—Dumping Bottoms.

50,552—October 24, 1865. JACOB BOWERS. *Improvement in coke ovens.*

Claims placing the opening or doorway for discharging the contents of the oven below the level of the bottom of the oven, in combination with a moving bottom, so constructed and arranged as to make a passage from the interior of the oven to the doorway when the bottom is tilted and to close the communication when the bottom is shut down.

129,803—July 23, 1872. JULIUS ERICHSEN AND JÖRGEN GEORG MAARDT *Improvement in coke ovens.*

Claims a hinged bed, in combination with ovens or fire chambers, and mechanism, for raising and lowering the front edge of the bed; also coke carts made with an inclined front, in combination with the hinged bed.

150,808—May 12, 1874. HENRY ZAHN. *Improvement in furnaces and processes for manufacturing coke and gas.*

Claims the combination of a coke oven, in which the waste products of combustion are partially or wholly confined, with a working chamber or heating grate, by means of a flue or flues, which serve to conduct and control the current of these products into the fire of said chamber or grate, and whereby said waste products of the first combustion are utilized.

151,513—June 2, 1874. LEWIS SCHANTL. *Improvement in coke ovens.*

Claims the combination of a coke oven, having circular flue and lateral flues, with an oscillating bottom, trunnions, plate, and pit.

163,333—May 18, 1875. LEWIS SCHANTL. *Improvement in coke ovens.*

Claims the combination, with a coke oven, of a bottom having a vertical and oscillating movement.

166,846—August 17, 1875. LOUIS CHARLES ERNEST CARRÉ. *Improvement in apparatus for economizing fuel.*

Claims the combination of a tilting grate and chute with a water pipe, arranged above the receptacle into which the coke is discharged.

225,296—March 9, 1880. WILLIAM A. MILES. *Charcoal kiln.*

Claims a chute having weighted doors arranged one above the other in a vertical plane.

386,427—July 17, 1888. DAVID EVANS AND ALBERT WILLIAM ADAMS. *Portable bottom coke oven.*

Claims in a coke oven having a pit below the level of its base or floor, the combination, with a movable bottom having a central opening, of a chain passing through said opening and through the eye of the oven, a portable crab above the oven mounted on rails, a spider or frame below the floor, and a car or truck mounted on tracks within said pit.

427,307—May 6, 1890. DAVID EVANS AND ALBERT WILLIAM ADAMS. *Portable bottom for coke ovens.*

Claims in a coking oven, the combination, with the piston of a hydraulic ram provided with a head having an upwardly extending conical projection, of a concave bottom provided with a central conical aperture adapted to receive the projection of the piston to support and center the bottom on the piston, and also to serve as a means for allowing the water thrown upon the coke to cool it after the bottom has been removed from the oven to flow off and leave the bottom clean and dry.

469,817—March 1, 1892. HUGH KENNEDY. *Coke oven.*

Claims in apparatus for coking coal, the combination of a stationary hearth on which the charge to be coked rests, an oven open at the bottom and set over said hearth with its sides extending to about the level thereof, and means for moving the oven laterally on the hearth, whereby the coked charge is dragged by the oven and removed from the hearth, said apparatus having a dumping place or drop in the path of motion of the oven.

499,565—June 13, 1893. GEORGE W. NIXON. *Coke oven.*

Claims the combination, with two sets of rails, arranged at an angle to each other, the lower rails being curved at their lower ends, of the traveling coke oven, having a base portion which travels on said lower rails, and a dome, or top portion, which is hinged to the rear edge of said base and provided with means for engaging with the upper rails, whereby the contents of the oven may be automatically dumped.

561,922—June 9, 1896. NORTON B. TAYLOR AND JOHN C. DIAS. *Coke oven.*

Claims a coke oven provided with a vertically movable bottom, comprising the metallic plate and noncombustible layer adjacent to the plate, the upper edges of the plate being flanged and extended inward over the noncombustible layer, and brick or tiling resting upon said layer and anchored to the plate, combined with a combined stop and scraper for said bottom.

728,953—May 26, 1903. GEORGE M. MILLER. *Coke oven.*

Claims the combination with a coke oven and an inclined floor therein, of an aperture in the floor, a frame, in the aperture, a slide plate working in the frame, and a chute underneath the frame and integral therewith, said frame and chute being made of heat-retaining material.

757,469—April 19, 1904. ANDREW C. KLOMAN. *Retort coke oven.*

Claims in a retort coke oven, a horizontal bottom, composed of pivotally connected sections, and means for elevating the pivoted portion of the same, whereby a fulcrum is formed for breaking apart the cake of coke and inclined beds are provided for the separated parts of the cake; and also, in a retort coke oven, a series of parallel ovens, walls common to each two adjoining ovens, a series of uptake and downtake flues in each wall associated respectively with said ovens, an offtake flue common to each series of uptake and downtake flues, and a main offtake flue common to the other offtake flues.

757,509—April 19, 1904. WILLIAM M. SCOTT. *Retort coke oven.*

Claims in a retort coke oven plant, a battery of coke ovens having pivotally mounted bottoms, a car arranged to travel beneath the said bottoms, a beam on the car, means mounted on the car and adapted to be operatively connected to any selected bottom for swinging the same on its pivotal mounting, and means cooperating with said beam for sustaining the reaction of said first-named means while operating the said bottoms.

Subclass 8.—Coke Processes.

93,629—August 10, 1869. WILLIAM J. LYND. *Improved process of preparing coke from Colorado and other coals.*

This is accomplished by coking the coal in ovens or kilns so arranged that when all the coal is in a state of combustion the draughts can be closed and the process is hastened and improved by the introduction of carbureted hydrogen gas or vapor from oil, coal tar, or other hydrocarbons.

98,606—January 4, 1870. WILLIAM JOHN LYND. *Improved process of preparing coal for smelting ores.*

The inventor places a mixture of five-sixths of coal and one-sixth of quicksilver in a furnace, thoroughly ignites, and then closes the furnace, or he makes briquettes of powdered coal and pine tar or other hydrocarbon and cokes them in a retort.

117,714—August 1, 1871. WALTER McPHEETERS AND CHARLES PEARCE. *Improvement in the manufacture of coke.*

This invention relates to improvements in ovens and a new process for making coke of slack bituminous coal, and consists in an oven composed of four vertical side brick or stone walls, traversed between said walls in both directions by V-shaped flues, formed of planks or slabs of wood, whereon the slack coal is packed as high as the walls will admit, around numerous small pieces of wood set endwise upon the flues, to form vertical passages by being drawn out after the slack is packed. The fire is set in each end of the largest flue, it is allowed to burn a sufficient time to expel the sulphur, and then put out by flooding. After the fire is started, should the slack become heated unevenly, the heat may be reduced by covering such overheated portion with earth or clay, which is removed when an even temperature throughout the oven is attained; or it may be sufficient to drop balls of mud over the vertical flues in the overheated portion, thus shutting off the draft and causing the heat to be evenly diffused throughout the slack.

136,592—March 11, 1873. HENRY ENGELMANN. *Improvement in processes for making coke from lignites.* (*Reissued July 15, 1873, No. 5,486.*)

The object of this invention is to provide a process of effectually coking brown coal, lignite, and other coal-like material incapable of being coked in the usual operation of an ordinary coking oven or retort, and consists in mixing with the lignite or other refractory material to be coked coal tar or certain varieties of bituminous coal or asphaltum or analogous substance and subjecting the material thus prepared to an initial and sustained heat above a cherry-red, laterally applied, sufficient not only to volatilize the hydrocarbons and eliminate the volatile matter contained in the mass, but also to decompose the aforesaid hydrocarbons into gases that may be conducted away and carbonaceous matter, that, being distributed through the mass, serves to cement the fragments of lignites or equivalent material together to form a compact product capable of use in the same manner as coke made wholly from "coking" or "caking" coal, this result being in contradistinction to that shown in the fragmentary and comparatively uncoked product obtained by subjecting lignite or like substance to the action of the coking apparatus hitherto in use. The invention also includes compacting the charge during or after its introduction to the coking furnace by subjecting it to pressure, as by compressing rollers, whereby the relative solidity of the mass and its integrity when used or applied for fuel purposes are materially enhanced; and,

Claims the process of coking brown coal, lignite, and analogous coal-like material incapable of effective coking by the usual practice with ordinary coking ovens by mingling the same with coal tar, asphaltum, or analogous substances, or with bituminous coking coal, or with coal tar and coking coal together, and subjecting the whole to an initial and sustained heat above a "cherry-red," so termed, and applied laterally throughout the mass.

150,872—May 12, 1874. WILLIAM J. LYND. *Improvement in coking fossil coals or lignites.*

Claims the process of treating fossil coals, as designated, by reducing the coal to a finely divided or powdered state, and then subjecting the same, whether mixed or not with a powdered or finely divided hydrogenous coal, to the coking operation.

150,873—May 12, 1874. WILLIAM J. LYND. *Improvement in coking fossil coals or lignites.*

Claims the mode of coking coals commonly known as lignites by coking the mass from the bottom upward and carrying off the gases in the opposite direction, the same being effected by the admission of air from above in small quantity at first, and the gradual diminution and final cutting off of said air supply as the coking proceeds and before it is terminated, the coking of the upper part of the mass being effected by radiation from the lower ignited portion.

The combination, with the charge chamber and the chimneys communicating therewith at or near the level of the floor or hearth, of one or more air-supply pipes or apertures, located in the top or arch of the oven, and communicating with said chamber.

The air flues beneath the oven floor or hearth for conveying air to the interior of the charge-chamber.

175,744—April 4, 1876. WILLIAM PENROSE AND WILLIAM F. RICHARDS. *Improvement in processes of making coke.*

The invention consists in the mixing or incorporating of anthracite or stone coal, or free burning steam coal, or coal known as Staffordshire slack, or other noncoking coals, with bituminous coal, or any other coal capable of making coke, together with pitch or tar, or with any form of tar or bitumen mineral oils containing bitumen, petroleum, or any of the waste products of petroleum, such coal or coals, pitch, tar, or other bituminous matters being ground and mixed together, and the mixture thus produced placed in any well-known form of oven or retort commonly used for coking, and the surface then covered with a layer of bituminous coal or other bituminous matter.

221,257—November 4, 1879. LEVI STEVENS. *Improvement in processes and apparatus for utilizing in furnaces the gases from coking coal.*

Claims the method of utilizing the gases arising from coking coal for fuel in furnaces, which consists in conveying said gases from the cells or chambers wherein the coking is in progress into a chamber adjacent to the furnace, then driving them with great force into the interior of the furnace, and there causing them to encounter a current of atmospheric air, whereby they burst spontaneously into flame, and develop great heat, susceptible of application to drying the coal and to other purposes, and the apparatus by which this is accomplished.

285,945—October 2, 1883. LAWRENCE H. ARMOUR. *Method of and apparatus for the treatment of spoil heaps of collieries.*

Claims the mode of treating the spoil heaps of collieries, peat bogs, and similar materials for the recovery of the volatile products therefrom, and for other purposes, consisting in closing the surfaces of the heaps practically air tight, and then withdrawing the gases arising from combustion by exhaustion and condensing the exhausted gases.

288,716—November 20, 1883. JEAN A. MATHIEU. *Process of manufacturing charcoal.*

Claims the process of removing deleterious substances from charcoal and rendering it more dense, which consists in washing the vapor of a distilling charge of wood, as described, and subsequently forcing the gases remaining uncondensed upon a charge of heated charcoal.

307,050—October 21, 1884. JOHN JAMESON. *Manufacture of coke.*

Claims in the manufacture of coke according to the ordinary process of igniting the charge at the top and burning gradually downward, the combination, with an oven provided with openings for giving ingress to the air and egress to the products of combustion at the upper part of said oven, of the outlet and exhaust for withdrawing from the lower part, and practically closed to the admission of air at the lower part, of the oven, the gases and vapors generated in or distilled from the coal below that in combustion, the purifiers, condensers, or scrubbers for treating said gases or vapors to recover therefrom materials such as oil, ammonia, and the like, and the pipes and connections for introducing at an advanced stage in the coking a regulated supply of the purified hydrocarbon gases or vapors at the bottom of the charge.

318,497—May 26, 1885. HENRY M. PIERCE. *Process of manufacturing coke.*

Claims, in the art of manufacturing coke, the method of conducting the furnace operation and increasing its yield, which consists in partially filling the oven with an initial charge and coking the same by downward progression; then, while such charge remains stationary within the oven, and near the end of the said coking operation, filling the oven to a further height by an additional charge, thereby retarding the coking of the initial charge, coking the second charge, and proceeding in like manner, the coking going on progressively until the oven is filled.

320,627—June 23, 1885. ARTHUR MARSHALL CHAMBERS AND THOMAS SMITH. *Method of coking coal.*

Claims the method of coking consisting in introducing an upwardly or horizontally directed current of hot air alone to the interior of the upper part of the oven and drawing the products of combustion down through the coal, the oven being without other inlet than said hot-air pipe during said operation, and the direction of the jet or current of air away from the coal, insuring uniform pressure on the latter and preventing it from being burned away or injured.

330,731—November 17, 1885. HENRY M. PIERCE. *Process of manufacturing coke.*

Claims, as an improvement in the art of manufacturing coke, the method of conducting the furnace operation which consists in heating the charge by radiation until inflammable gases are given off, then leading said gases beneath the floor of the coking chamber and burning them therein, thereby coking the under layers of the charge by radiated heat, and finally shutting off the flow of gases to the under combustion chamber and burning them in the top of the kiln, thereby coking the top layers of the charge by direct heat.

332,613—December 15, 1885. ISAAC M. KELLEY. *Manufacture of coke.*

This invention relates to a new and improved process of preparing coal for the manufacture of coke, and to apparatus therefor; and it consists in first separating the slack from the coal and at the same time washing it by jets of water, after which the slack and fine coal are ground to the required size and saturated, coated, or mingled with water, hydrocarbon oils, or other hydrogenous matter during the grinding operation, to supply a sufficient amount of hydrogen or carbon to facilitate the coking of the coal in coke ovens.

379,960—March 27, 1888. CHARLES H. LAND. *Manufacture of refractory carbon.*

Claims the process of producing a refractory carbon, consisting in subjecting carbonaceous matter in an open muffle located in a furnace to the products of combustion under pressure, whereby a counter resistance is offered to expel oxygen from the muffle, prevent ignition of said matter, and drive off determined elements therefrom.

388,542—March 23, 1886. JAMES J. McTIGHE. *Manufacture of hard carbon.*

This invention relates to the manufacture from the so-called ' natural gas" obtained in large quantities in certain parts of this country, and chiefly utilized at present for consumption in furnaces in various industries, of a dense hard carbon or coke, which in chemical constitution, in physical structure and characteristics, in appearance of surface and fracture, and in fitness for certain industrial uses differs essentially from any and all other forms or varieties of carbon known, and is readily distinguishable therefrom. This product is eminently useful for metallurgical purposes, and, in fact, wherever hardness, purity, fine texture, and uniform density are desired. It has, moreover, properties that render it particularly suitable for use in the manufacture of carbon pencils or electrodes for electric lights. The mode of treatment consists, briefly, in taking natural gas and decomposing it by heat, and precipitating the nascent molecules of carbon into a solid agglomerate.

421,299—February 11, 1890. HUGO MÜLLER. *Art of manufacturing coke.*

Claims as an improvement in the art of manufacturing coke from anthracite coal dust, the process which consists in aggregating the coal dust into boulets, then piling the boulets up in an oven or furnace, leaving continuous air channels from the bottom of the pile to its top, then passing through these channels a current of highly heated or ignited gases free from oxygen, and finally withdrawing the ready-formed coke from beneath while fresh lumps are fed in from above.

472,621—April 12, 1892. FREDERICK JOSIAH JONES. *Process of making coke.*

Claims in the process of making coke and obtaining by-products, the improvement which consists in cooling and washing the mixed gases resulting from the coking operation, collecting the condensable constituents, passing the cooled and washed gases through a purifier, then mixing them with fresh gas-producer gases generated from coke and with air, and finally passing the gases resulting from the combustion of the purified and reheated gaseous mixture through a fresh or partially coked charge.

485,904—November 8, 1892. JAMES C. ANDERSON. *Method of manufacturing or burning coke.*

Claims the process and method of coking coal, which consists in loading the coal upon a series of cars, igniting the coal upon the initial end of the train in any well-known manner, then passing the loaded cars consecutively through a tunnel way, utilizing the heat from the successively burning loads to heat the tunnel way and ignite and coke the charges of coal on the succeeding cars, and finally passing the cars out of the tunnel way at the opposite end to that in which they enter, thus constituting a continuous and progressive method and avoiding frequent handlings.

486,100—November 15, 1892. JAMES J. FRONHEISER AND CHARLES S. PRICE. *Manufacture of coke.*

Claims the process of manufacturing hard coke, which consists in pulverizing soft coal, mixing therewith a suitable hardening substance, charging the same into ovens, and heating them, and as a new article of manufacture, coke hardened by combining with it caustic lime or other suitable solid hardening substance in the process of its manufacture in such a manner that the proportion of its cell space to its cell walls is diminished, giving to it greater density and firmness.

511,334—December 26, 1893. GEORGE C. HEWETT. *Process of making coke.*

Claims the process of making coke, which consists in first heating comminuted coal at a low temperature under pressure greater than twenty-four inches of water, and then subjecting the thus prepared coal to a higher temperature and drawing off the volatile matters as in the ordinary coking operation.

609,150—August 16, 1898. JOHN THOMAS KEY. *Process of and apparatus for manufacturing coke.*

Claims the process of producing coke, which consists in igniting a charge of smudge at its top surface and introducing a supply of air above the same, producing a downward draft through the charge and thereby drawing the products of combustion through the same until the volatile constituents of the coal have been driven off, and then shutting off said downward draft and forcing steam in beneath the coke and up entirely through the same in the opposite direction to the original downward draft, in such quantity that the coke is thereby quenched and the remaining sulphurous fumes driven out thereof, and a coke oven comprising an oven proper having a false bottom consisting of three layers of bricks, pipes arranged to draw the products of combustion downwardly through the said false bottom, said pipes being connected with suitable exhausting and condensing apparatus, pipes extending around the circumference of the false bottom, adjacent to the middle layer thereof and provided with a plurality of openings, these latter pipes being connected with a steam supply, and pipes for the admission of air connected with a plurality of holes extending around the oven above the level of its charge.

613,980—November 8, 1898. EDWARD M. EIDHERR. *Process of eliminating impurities from coal, etc.*

Claims the process for the elimination of impurities from coal and ores during the coking or roasting process, consisting of the introducing into contact with the raw material by the aid of superheated steam, a quantity of glycerin and hydrochloric acid, and later introducing a quantity of glycerin and nitric acid, by the aid of superheated steam, and then subjecting the finished product to the action of the superheated steam.

627,595—June 27, 1899. FREDERIC W. C. SCHNIEWIND. *Coke oven and method of operating same.*

This invention relates to the construction and mode of operation of closed, externally heated coke ovens, having for its purpose the separate collection of the gases of varying richness and value given off at different stages of the coking operation, the drawing off of the gases at different stages of the operation by sucking or exhausting devices working at different pressures, the quenching of the coke while still in the oven and with utilization of its heat for the manufacture of water gas, and the carbureting of that portion of the water gas which is on generation of sufficient heat to crack hydrocarbon oils. And it consists in drawing off the gases generated in the oven at different stages of the coking operation through different gas mains and by means of exhausting devices working at different pressures, whereby the pressure in the ovens may be maintained approximately constant and approximately equal to the pressure in the surrounding heating flues. In this way it will be obvious that not only will the poor and rich gases be collected separately, but the loss of oven gas or its admixture with heating flue gas practically prevented.

637,255—November 21, 1899. JOSEPH HEMINGWAY. *Process of making coke.*

Claims the process of coking coal, which consists in confining the coal in an oven, firing the coal, then introducing into the oven, above the coal, an extraneously heated deoxygenized blast of a temperature, before its introduction, greater than that usually employed in the coking operation, to increase the heat in the oven above the temperature produced by the combustion therein of the gases generated from the coal and to accelerate the generation of such gases, and then permitting the deoxygenized blast and that portion of the evolved gases not converted into fixed carbon to escape through an opening at the top of the oven.

641,591—January 16, 1900. CHARLES B. JACOBS. *Conservation of volatile products from beehive coke ovens.*

Claims the method of collecting the volatile products in the coking of coal in beehive ovens, which consists in laterally deflecting the volatile products from the charging hole of the beehive oven by means of suction applied laterally to such charging hole, such suction being insufficient to affect the natural draft of the oven, and communication with the outer air being maintained through such charging hole.

644,012—February 20, 1900. JOSEPH HEMINGWAY. *Process of distilling coal.*

Claims the method of heating a part of a battery of coke ovens, which consists in utilizing the waste heat of one-half of said ovens, and also the heat obtained from the combustion of the volatile products of said half of said ovens, to heat and force air into the other half of said ovens.

680,780—August 20, 1901. WILLIAM JOHN KNOX. *Process of manufacturing coke.*

The general plan of the invention is to pass the hydrocarbon vapors generated in the coke ovens through suitable stoves, in which more or less of the heat carried by the vapors is conserved or stored, thence through cooling devices—such, for instance, as a steam generator—thence into heating stoves, where the temperature is raised to the degree required for effectively acting upon the coal to reduce it to coke. These heated vapors are then passed into the coking ovens and usually across the top of the bed of coal or coke. This operation is continued until the stove which has been employed as the heat absorbing stove has absorbed and stored a predetermined amount of sensible heat, whereupon the direction of circulation is reversed and this stove is utilized as the heating stove and the former heating stove as the heat absorbing stove, and this operation of reversal is repeated continuously at suitable intervals as long as the temperature of the stoves is sufficiently high to conduct the coking operation.

680,783—August 20, 1901. WILLIAM JOHN KNOX. *Manufacture of coke.*

This invention provides a process of making coke for metallurgical purposes by introducing a heated gas into the interior of a coke oven above the body of fuel and liberating heat from the gas within the oven by direct radiation, by contact with the coal or coke and with the walls and arch of the oven, and then by radiation from the walls and arch of the oven. The coking action resembles in some respect what is known as the "beehive" process in supplying the heat from above and acting downward on a comparatively thin broad layer of coking coal, which is free to expand, and the oven may be of the same general form as the beehive oven or the Welsh or Thomas oven. It differs from the beehive process, however, in not supplying air for the combustion of the fuel within the oven, the doors or openings and the charging openings being completely closed during the process, the charge of coal being converted into coke by baking from above by the action of heat carried into the oven from the outside by the fluid carrier.

706,443—August 5, 1902. PAUL NAEF. *Process of making coke.*

This is a continuous process, and the inventor claims in a process for producing coke, passing a mass of finely divided carbonaceous material through a shaft or furnace, generating a gas under pressure and heating said gas and coking said carbonaceous material by injecting said heated gas under pressure into the mass as it passes through the furnace or shaft, at a point between and a considerable distance from the ends of the furnace or shaft through which said mass passes, whereby portions of the mass will be coked successively and the hot gas with by-products absorbed thereby will ascend through the uncoked portion of the mass and be permitted to pass from the upper end of the shaft or furnace.

725,904—April 21, 1903. JOHN F. WILCOX. *Process of manufacturing coke.*

Many objections have been raised to the use of coke made in retort or closed coke ovens for metallurgical purposes, based mainly on the presence of a greater or less amount of spongy, porous, friable coke. The inventor seeks to prevent the formation of this spongy, porous, friable coke by the process of manufacturing coke in retort ovens, consisting in forming outside the ovens the charges with a portion or portions of the same spaced apart, the spaced portion or portions extending from the top of the charges to a short distance from the bottom, entering the charges into the ovens, and heating the same.

731,949—June 23, 1903. JOHN A. POTTER. *Method of making coke and gas.*

This invention is for a continuous process of coke and gas making and there is claimed the method of making coke and gas, consisting in maintaining a vertical burden, intermittently feeding coal to the upper end and shearing off and removing coke from the lower end of said burden, drawing the lean and fuel gas from an intermediate point of the charge, and burning it around the intermediate and upper portion of the charge, and withdrawing the rich and illuminating gases from the upper end of the charge for further use.

744,667—November 17, 1903. BERNHARD ZWILLINGER. *Process of carbonizing.*

This invention relates to carbonizing wood, and there is claimed the carbonizing process which consists in mixing an excess of air with combustible gas, heating the mixture under the exclusion of further atmospheric air in a confined space bringing the resultant gases into contact with material to be carbonized under the exclusion of atmospheric air so as to carbonize the material partly by the heat of the gases, partly by the combustion of the hot combustible gases introduced and partly by the combustion of the gases given off from the material being carbonized.

755,155—March 22, 1904. EDWIN A. MOORE. *Process of quenching and bleaching coke.*

Claims the process of extinguishing and bleaching coke, which consists in transferring hot coke from an oven into a receptacle from which atmospheric air is excluded, deluging the coke with water and discharging the excess of water as rapidly as it is supplied, and then subjecting the coke to steam generated in the receptacle by the heat in and the water on the coke.

763,339—June 28, 1904. MICHAEL R. CONLEY. *Process of making coke.*

Claims the process of making coke, which consists in inclosing the coal in an essentially air-tight oven of nonconducting material and raising the inner wall of the oven by means of electrical resistances included in the wall to a temperature higher than that obtained in the ordinary coke oven.

769,241—September 6, 1904. CHARLES F. SPAULDING. *Process of coking coal.*

This invention relates to beehive ovens, and the inventor claims the process of coking coal, which consists in confining the coal in an oven, firing the coal, and then forcing into the oven above the coal a blast of combined air and oxygen.

788,558—May 2, 1905. ALBERT D. SHREWSBURY. *Process of producing compressed coke.*

The object of this invention is to provide a practically continuous and simple process for producing compressed nonporous blocks or briquets of coke designed to be used as fuel, since compressed coke has many advantages over ordinary coke and for some purposes is superior to anthracite coal. It is compact, easily handled, occupies but little space for shipping, is free from sulfurous and other noxious gases, it burns freely, and is almost entirely consumed, leaving but little clinker or ash. In carrying out the process the coke is taken from the coke oven at the time when it has reached a plastic or agglutinate state and compressed into blocks of the desired size and shape. These blocks or briquets may be produced as a by-product of a gas producing plant, or the product may be the result of a specially designed apparatus in which the gas may be regarded as a secondary consideration. The coke is dumped into the compressor as quickly as possible to avoid the ignition and consequent combustion of the same.

Subclass 9.—Coke Ovens—Retort Ovens.

19,575—March 9, 1858. DANIEL C. KNAB. *Improvement in the manufacture of illuminating gas.*

This invention consists principally in the peculiar consideration and operation of carbonizing furnaces, and what distinguishes these furnaces from all others heretofore in use is that while carbonizing coal on a large scale the inventor obtains besides the coke all other accessory products of the distillation, such as tar, ammoniacal liquor, and gas, and he provides for the reworking of these secondary products so as to obtain benzol, creosote, sulphate of ammonia, and a variety of other products.

37,412—January 13, 1863. WILLIAM GEORGE VALENTIN. *Improvement in coking coal and generating gases.*

Claims coking coal in close chambers or retorts heated externally by the combustion of gases generated from similar previous coking operations, and applied in the manner set forth, and the use of vertical close chambers or retorts, in combination with external flues or heating channels supplied with combustible gases and air from burners. The inventor quenches his coke with hydrochloric acid gas or dilute hydrochloric acid which it is alleged removes part of the sulphur from the coke.

65,820—June 18, 1867. FREDERIC J. F. LAUMONIER. *Improved circular coke oven.*

Claims a circular coke oven, composed of any suitable number of radial compartments converging towards a central chimney, in combination with flues for conducting the products of combustion from the said compartments to the central chimney, the combination, with the radial compartments provided with openings in their top, of a circular railway passing over the said openings, and a water conduit or pipe encircling the oven.

103,507—May 24, 1870. LEWIS SCHANTL. *Improvement in coke ovens.*

Claims the combination and arrangement in pairs of two or more coke ovens, in such a manner that the burning gases given off by the coal in each may, by means of vertical and side flues, be made to pass around the sides and bottom of both ovens, for the purpose of more evenly and effectually distributing the heat to all parts of each oven, and the construction of the walls of U-shaped blocks, which at the same time form the vertical flues.

105,413—July 19, 1870. LEONARD FORBES BECKWITH AND ARTHUR BECKWITH. *Improvement in coke ovens.*

This invention consists in a novel arrangement of vertical and horizontal flues, chambers, and communications, whereby the gases evolved in coking are utilized in a most advantageous manner, and includes a tongue construction of fire bricks applied to form the flues through which the gases are circulated, and serving to brace the walls of the oven. The invention is applicable to coking various kinds of coal, either separately or mixed, with or without a cementing substance—such, for instance, as coal tar or asphalt.

119,092—September 19, 1871. THEODORE G. MEIER. *Improvement in coke ovens.*

The improvements relate: To such a novel arrangement of vertical and horizontal flues that each oven gives as well as receives heat, and whereby the gases are utilized and the generated heat is equally distributed to all parts of the oven; to a peculiarly constructed right or left trough-shaped tile, forming the upper and lower inlet and outlet connections with vertical and horizontal flues; in forming a skew-back tile with two horizontal holes and one diagonal hole or flue, whereby said tile is also made right or left in combination with trough-shaped tile; in arranging, in combination with vertical and horizontal flues, a system of pipes to aid combustion of gases by the introduction of cold or hot air or steam; the arrangement and construction of all said parts being such that every oven can be operated separately or independent of adjoining ovens.

141,778—August 12, 1873. HENRY ENGELMANN. *Improvement in coking furnaces.*

Claims the combination, with narrow and high ovens, of the vertical heating flues, provided in the walls between these ovens, constituting, in fact, as many different heating furnaces, and a valve or equivalent means of throttling or stopping the outflow of gases from the material subjected to coking, whereby the retention of the gases long enough to secure the most efficient deposition of carbon therefrom is provided for.

141,779—August 12, 1873. HENRY ENGELMANN. *Improvement in coking furnaces.*

This invention consists in the combination of vertical flues arranged in the side walls of coking ovens, of peculiar height, with gas or flame conduits, diminishing in transverse area as the number of flues to be supplied diminishes, in such manner that combustible gases to be burned in the flues themselves, or flame and hot products of combustion from the burning of such gases in the conduits, or flame and hot products of combustion from a furnace connecting with the conduits, will (one or the other, as the case may be) be uniformly distributed throughout whole series of flues to uniformly heat the ovens throughout their length. The invention also comprises certain novel means of supplying the requisite quantity of air to the burning fuel, of equalizing the draft of the heating flues, and of facilitating the removal of the coked product from the oven.

169,756—November 9, 1875. HENRY AITKEN. *Improvement in coke ovens.*

The object of this invention is a coking oven in which air, after being thoroughly heated by passing through heated channels, is directed among the gases arising from coke arranged upon a stationary or movable bottom. The claims cover special combinations of oven, passages, heating pipes, flues, and tuyeres, with mechanism for operating the movable bottom.

171,371—December 21, 1875. EMIL S. GOBIET. *Improvement in coke ovens.*

This invention consists in combining with a coke oven a series of side flues, bottom flues, and top flues, the side flues being made to communicate with the interior of the oven in such a manner that the heated gases which escape from the oven envelop said oven from all sides, and thereby a uniform heat is produced, and the formation of coke is materially facilitated.

176,379—April 18, 1876. SEBASTIAN STUTZ. *Improvement in coke ovens.*

The invention consists in the particular construction and arrangement of a coke oven, called independent—that is, which can be erected and worked either separately or in connection with any desired number, and in which the openings and chambers are so combined that part of the produced gases resulting from the coking heats the oven itself, whereas the remaining gases, usually wasted, may be collected in a reservoir, and either admitted to a boiler or puddling furnaces for heating them; or they may be exhausted from the reservoir, and cleaned for illuminating purposes; or they may be let into the open air through a chimney and wasted.

180,010—July 18, 1876. SAMUEL DIESCHER. *Improvement in coke ovens.*

This invention relates to an improvement in coke ovens; and it consists in the construction and arrangement of gas and air flues for the purpose of cooling by the latter the foundation and lower portions of the brickwork of the ovens, and also for using the air, after becoming heated and intermixed with the gas escaping from the coal during the process of coking, to obtain an intense heat by a thorough combustion of the gas.

208,930—October 15, 1878. WILLIAM H. ROSEWARNE. *Improvement in coke ovens.*

Heretofore, in the process of coke making, a considerable amount of fuel has been consumed in igniting the charge of coal, and after ignition a still greater waste was occasioned by allowing the burning gases from the charge to pass off without doing any useful work. To prevent this loss, and to also shorten the time of the process, the inventor constructs the coke ovens in pairs, so that they may act conjointly, and in the dividing wall, near the top, he arranges, in a horizontal line, a number of connecting flues, capable of being closed or opened by a horizontal damper, so as to allow the burning gases from the operating oven to be conducted over for the purpose of igniting the fresh charge in the other oven; and in order to insure rapid combustion he provides a series of flues, so arranged as to conduct the gases from the ignited charge under the hearths, said hearths being sufficiently elevated and mounted on rollers in order to facilitate the charging and discharging of the ovens. Walled spaces beneath the hearth, and formed by it, constitute subhearth flues, which communicate by other similarly formed flues with the stack.

273,822—March 13, 1883. RICHARD DE SOLDENHOFF. *Coke oven.*

This invention relates to certain improvements upon the well-known Coppée coke ovens, and consists, first, in increasing the heating surfaces in the oven to their maximum. The increase of heating surfaces is attained by giving to the oven the shape or form of a rectangle, in which the numerical value of its area is not more than half of the numerical value of its periphery, and second, in the means of restoring the heat to the ovens, which would be otherwise lost, and third, the arrangement of the cross flues outside the oven.

279,099—June 5, 1883. FRITZ LÜRMANN. *Apparatus for the continuous distillation, sublimation, or roasting of solid materials.*

Claims, in a distilling kiln or coking oven, the working-oven having its bottom, side, and top walls formed all of thin fire brick placed flat-wise in the walls, braced or supported at their joints all round the oven by right-angled walls, which also form flues bounded in one direction by the thin walls of the oven floor and sides, and the top chambers, in combination with a charging apparatus arranged to force solid materials through said oven.

281,046—July 10, 1883. HERMAN FRASCH. *Furnace for the manufacture of carbon.*

This invention relates to an improvement in furnaces for the manufacture of carbon for electric light carbons and other purposes; and

Claims a furnace for the manufacture of carbon, constructed with a flat floor or hearth composed of tiling with packed joints and capable of retaining a liquid or semiliquid substance thereon, flues extending beneath the entire floor, discharging doors located on a level with the hearth or floor, and a charging door located above the level of the hearth or floor.

282,064—July 31, 1883. FREDERICH C. EBERLEY AND RUDOLPH RICHTER. *Coke oven and kiln.*

This invention relates to an improved oven in which coal is reduced to coke and the heat utilized. After the first ignition, and when the ovens and inclosing masonry have become heated up, the coal in the ovens is fired by the heat of the masonry. The smoke arising finds an outlet through apertures made in the arch of the ovens into channels suitably located. The gas arising and passing out through side apertures comes in contact with air from the exterior introduced through suitable channels, and is ignited, thereby thoroughly heating the masonry of the ovens. The products of combustion thus produced ascend through vertical flues into a main channel or flue, which conveys them to the kilns in which the burning is to be done. These kilns are suitably located between the series of coke ovens, so that the heat given off by the surrounding masonry of the coke ovens, as well as the products of combustion above described, is thus utilized. The arrangement of the flues conveying the ignited gases to the kilns is such that they may be taken to one kiln and then discharged into the smokestack, or if they are not spent, may be carried on to another kiln.

282,604—August 7, 1883. JOHN F. BENNETT. *Apparatus for the manufacture of bituminous coal coke.*

Claims a combination of furnace, flat-arched-roofed ovens, passages, flues, boilers, fan, valve, gas holder, pipes, hood, cars, track. He cools his coke by steam.

287,332—October 23, 1883. LOUIS SEMET. *Coke oven.*

The improved kilns or ovens consist of a series of massive vertical walls connected together at their upper ends by arches or vaults which support the superstructure of brickwork, and with the walls form a series of coking or distilling chambers. Within these chambers, and on each side of the vertical walls, are placed large hollow bricks of fire clay, the sides of which bricks are made thin, so as to allow of the heat passing easily through them. The said hollow bricks are placed either vertically side by side or horizontally one above the other, and through the said hollow bricks the gases and products of combustion are caused to circulate. The result of the above described combination of a massive wall covered on each side with series of hollow fire clay bricks is a sort of threefold wall extending throughout the entire height of the chamber, wherein the coal to be coked or distilled is to be placed. From suitable furnaces the flames and products of combustion pass under the soles of the chambers, and at the rear end of the said chambers they separate into two currents, which pass through the series of hollow bricks, whether disposed horizontally or vertically, the velocity of the said currents being regulated by suitable dampers. If required, a second inlet for gases and air may be arranged by means of branch flues placed underneath the gas flues, and vertical ducts may be formed in the massive walls, to conduct heated air to the parts where the gases enter. When arranged side by side, the hollow bricks form vertical flues, and when placed one above the other the hollow bricks form horizontal flues, and in both cases they constitute hollow sides of the central massive wall. Longitudinally the walls are consolidated by means of suitable tie rods, and the bricks are prevented from sliding transversely by the bricks forming the soles and arches of the kilns or ovens. The said bricks may also be connected together by grooves and tongue pieces throughout their length.

287,905—November 6, 1883. FRANÇOIS CARVES. *Coke oven.*

Claims, in a closed coke oven heated by external firing, the combination of coking chambers, partition walls, horizontal zigzag flues in the partition walls, communicating at their upper ends with flues beneath the bed of the oven leading from the firing place, and at their lower ends with the chimney, so that the hot combustion gases shall pass to the top of the zigzag flue and travel downward therein before escaping to the chimney.

288,874—November 20, 1883. GEORGES SEIBEL. *Coke oven.*

This invention relates to the manufacture of coke from coal, especially from bituminous coal, and is based on the fact that the hydrocarbon gases produced by the distillation of coal, and passing at a high temperature through a mass of coal which is being converted into coke, yield a portion of their carbon to the spongy material through which they are passing, and that the quantity of carbon thus given off increases with the thickness of the coal stratum through which the said gases are filtered, and consists of a peculiar combination of flues and tuyeres in a coke oven, which dispenses entirely with a grate, and is heated by the gas arising from the distillation of the coal.

291,422—January 1, 1884. HEINRICH STIER. *Coke oven.*

Claims the combination, with a generator, and coke shafts, of channels, arranged in front of and surrounding said generator and coke shafts, said channels being composed of layers of perforated stone, or its described equivalent, for heating the gas or air used for combustion; and the combination of the movable slides or registers with the entrance and exit channels of the coke chambers, said slides being arranged substantially as shown, whereby, by their proper adjustment, each coke chamber may be utilized as such, or by closing the passage for the outflowing products of distillation and connecting the coke chamber with the main gas channel, each coke chamber may be utilized as a generator.

293,023—February 5, 1884. ARTHUR RICHARD BALDWIN HILTAWSKI. *Coking furnace.*

The invention consists in a coking furnace constructed with a series of coking chambers for receiving the coal to be coked, between which coking chambers gas chambers are arranged, into which gas is passed from the coking chambers, the said gas chambers being provided in their bottoms with openings leading to transverse channels connecting a series of longitudinal channels below the gas chambers, so that the gases will circulate until exhausted, and then pass off through a suitable channel leading to the smokestack.

302,171—July 15, 1884. HEINRICH STIER. *Coke oven.*

Channels or pipes are arranged in the upper part of the apparatus for utilizing the radiating heat, through which channels or pipes air and water are forced, and in which they become heated, the water being turned into steam. The air may be forced in under pressure. The steam is serviceable for transformation into water gas, which transformation can be accomplished by forcing the steam, either alone or together with air, into the coke chamber. For this purpose the coke chambers may be provided with a pipe or other opening leading into said coke chamber. This construction of oven may thus be used for treating bituminous and carbonaceous substances for obtaining heating gases and products of distillation.

308,133—November 18, 1884. FRANÇOIS CARVES. *Coke oven.*

Claims, in combination with a range of coke ovens heated by external firing, one or more external horizontal smoke flues extending along the range of ovens with the firing places of which it or they communicate, and one or more air flues arranged alongside of the said smoke flues, through which air flues the air supply to the said firing places is made to pass, so as to take up the heat given off to the walls of the smoke flues by the combustion gases.

318,496—May 26, 1885. HENRY M. PIERCE. *Coke oven.*

Claims a coking oven having a coking chamber, a combustion chamber arranged immediately under the coking chamber so as to heat the same, and a central gas-exit flue which connects the upper part of the coking chamber with the combustion chamber, the floor of the coking chamber being inclined from the gas-exit flue to the discharge doors of the coking chamber.

330,732—November 17, 1885. HENRY M. PIERCE. *Furnace for the manufacture of coke.*

Claims a battery of coke ovens having each a closed coking chamber and basal combustion chamber, in combination with a receiving main extending along and common to all the ovens, valved branch pipes joining said main with each of the

closed chambers, a delivery main parallel to the receiving main, valved cross pipes connecting the two mains, and valved branch pipes connecting the delivery main with each of the combustion chambers.

338,605—March 23, 1886. JAMES J. McTIGHE. *Apparatus for producing hard carbon from hydrocarbon vapor.*

Claims an apparatus for producing coke from natural gas, comprising in combination a furnace structure, a vented retort set therein, a main supply gas pipe, a branch thereof communicating with said retort, and a second branch leading to said combustion chamber.

406,986—July 16, 1889. THEODOR BAUER. *Coke oven.*

Claims a coke oven having a series of radial retorts connected by ducts with a central gas conduit, an annular combustion chamber provided with air induction flues and surrounding said gas conduit, flues connecting the central conduit and the annular combustion chamber, and a central exit pipe within the gas conduit having its lower end connected with a series of gas outlet channels which are so arranged vertically between two series of horizontal air inlet channels that the air passing through said air inlet channels is heated by spent gases passing out of said vertical pipe.

407,879—July 30, 1889. ADAM WEBER. *Coke oven.*

Claims the combination of a coke chamber, a combustion chamber provided with a grate, each side wall of the combustion chamber having separate series of horizontal gas heating flues, gas supply pipes connecting with the front end of the lowermost gas heating flue, and lateral channels connecting the uppermost gas heating flues with the combustion chamber, and means for supplying air to the combustion chamber.

409,081—August 13, 1889. ADAM WEBER. *Coke furnace.*

Claims the combination of a coking chamber formed of blocks or tiles, a mantel surrounding the coking chamber, lateral brace blocks connecting the side walls of the coking chamber and mantel, and lateral plates connecting the upper corners of the coking chamber and mantel, said plates being provided with front and rear openings, and sliding dampers for regulating the size of said openings.

409,567—August 20, 1889. RICHARD DE SOLDENHOFF. *Apparatus for the manufacture of coke.*

Claims the combination, with two or more coke ovens and flues under said ovens, of an incinerating furnace situated between said ovens and consisting of two inclined chambers communicating at their upper ends, flues connecting the upper portions of said ovens with the lower ends of said inclined chambers, and flues under said inclined chambers connected with the upper ends thereof and with the flues under the ovens.

421,583—February 18, 1890. ISAAC N. KNAPP. *Coke oven.*

Claims in a stack of coke ovens, the combination of the ovens, combustion chambers situated below said ovens, chambers situated above said ovens, flues connecting the chambers below with the chambers above, a gas main connecting with the ovens, conduits arranged on each side of the stack connecting with the main and having independent stopcocks, a series of pipes leading from conduits to the chambers below, regenerators connected, respectively, with the chambers below by openings, chambers below and beside the grates connecting with the regenerators, an air chamber, a chamber connected with the stack, conduits leading from the said four chambers to a valve chamber, a four-way valve by which the air chamber can be connected with either of the regenerators and the stack with the other regenerator at will, and a steam pipe having branches extending into each oven and opening therein through numerous orifices.

436,882—September 23, 1890. CHARLES N. TRUMP. *Apparatus for making coke and gas.*

Claims the combination of a gas generator, a coke oven, a regenerator, a cooler, a scrubber, and gas connections extending from the generator through the regenerator, cooler, and scrubber, and back through the regenerator to the furnace of the coke oven.

445,394—January 27, 1891. EDWARD T. COX. *Apparatus for making coke.*

Claims a coking oven provided with a closed chamber with perforations in the bottom and adapted to receive the coal, a bottom channel leading to a receptacle for the liquid products below said bottom, a heating casing arranged within the chamber in position to be surrounded by the coal, and means for introducing a heating medium into the casing.

451,488—May 5, 1891. FREDERICK JOSIAH JONES. *Apparatus for making coke.*

Claims the apparatus for coking coal by the passage through it of the gases of combustion, such apparatus consisting in the combination of a gas producer, a central gas combustion chamber in communication with the producer and situated between duplicate sets of coking chambers, and of gas collecting chambers placed at the other sides of the coking chambers, the walls separating the coking chambers from the combustion chamber on the one hand and the collecting chamber on the other hand being perforated to give passage to the gases, the two coking chambers of each set having oppositely inclined floors, heating chambers beneath the floors, and inclined ledges or shoulders at the upper part of the side walls of the coking chambers.

455,684—July 7, 1891. WILHELM FRITSCH. *Coke oven.*

Claims the improvement in coke ovens, which consists in a plurality of vertical parallel coking chambers, a combustion chamber interposed between each two coking chambers, an air heating flue arranged immediately under the sole of the combustion chambers and provided with a plurality of air escape ports of different area opening into the combustion chamber at different points, a damper for the air port of greatest area, and flues for the escape of the products of combustion interposed between the air heating flues immediately under the sole of the coking chambers and in communication with the combustion chambers.

477,286—June 21, 1892. JOHN ARTHUR YEADON AND WILLIAM ADGIE. *Retort furnace.*

Claims a retort furnace, in combination with a retort revolubly mounted in the furnace, the interior of said retort being provided with stirrer blades tapering or diminishing in height toward the discharge end of the retort.

492,400—February 28, 1893. GUSTAV HOFFMANN. *Coke oven.*

Claims in combination ovens having the combustion chambers under the same, and shafts extending about them, canals at the top of said shafts, regenerators with air passages leading thereto, gas conduits leading from the ovens and ports connecting the same with the canals and the passages, leading directly from the regenerators to the canals and past the combustion chambers.

500,684—July 4, 1893. FRANZ WESTERMANN. *Regenerative coke oven.*

Claims in combination, two series of coking chambers with their independent combustion passages, pipes for supplying gas thereto, two regenerators arranged side by side and intermediate of the coking chambers and extending longitudinally from end to end of the series, a series of conduits extending from the regenerators, respectively, down between the separated passages, and having lateral branches connecting the conduits with the passages and the valves in the said lateral branches.

504,548—September 5, 1893. THEODOR BAUER AND GEORG MENDHEIM. *Coke and carbonizing oven.*

Claims the combination of a series of parallel carbonizing chambers, combustion chambers located near the tops of the carbonizing chambers and at the outer ends of the same, air heating apparatus, passages leading from the tops of the carbonizing chambers to the combustion chambers, passages leading downward from the combustion chambers near the outer ends of the carbonizing chambers, upward flues passing along the carbonizing chambers and flues placed in connection with said upward flues and conducting to the air heating apparatus; said air heating apparatus being provided with vertical downtakes for the waste gases connected at the bottom with the chimney, and also provided with air passages arranged to compel air and gas to travel in substantially opposite directions, inlets for atmospheric air connected to the bottoms of the air passages, and flues connecting the tops of the air passages with the combustion chambers.

510,448—December 12, 1893. MARTIN V. SMITH. *Oven for the manufacture of coke.*

Claims in combination with an outer wall, an interior oven within, a series of vertical flues between the wall and oven and encircling the latter, an annular gas flue arranged horizontally in the upper part of the outer wall and in connection with the vertical flues and a second annular horizontal flue for the air with passages therefrom to the vertical flues, gas and air supply pipes connecting with the flues, a draft stack leading from the base and passages from said vertical flues to said stack.

511,974—January 2, 1894. ARCHIBALD ROBERT STRACHAN. *Coke oven.*

Claims in a coking oven having a charging chute in its top and an exit flue communicating with said chute, also with diving flue and with a series of flues beneath the oven floor formed by the cruciform chamber inclosed by walls connected to the oven walls, said chamber being divided by a main partition connected to the oven wall adjacent the said diving flue and extending near the opposite side of the oven and also divided by a partition transverse to the main partition and terminating at each end near the oven wall, said flues beneath the floor communicating with an up-draft chimney flue, a part of said series of subfloor flues, next in the course of escaping products to the coking chamber, being situated adjacent to others more remote from said chamber to heat said more remote and relatively cooler flues by conduction through the intermediate walls and thereby quicken the draft therein.

513,257—January 23, 1894. THEODOR BAUER. *Coke oven.*

Claims in a coke oven plant, the combination of a series of horizontal retorts, combustion chambers located between the retorts at their outer ends and near the tops of the same, a series of vertical flame flues on the sides of the retorts, air heating apparatus located beneath the retorts, channels for leading cold air to and through the air heating apparatus, vertical hot air flues between the flame flues connected with the cold air channels, horizontal chambers between the combustion chambers, and communicating with the same and flues leading from the flame flues to and through the air heating apparatus and from the latter to the chimney.

516,184—March 13, 1894. FRANZ BRUNCK. *Coke oven.*

The object of this invention is to essentially increase the efficiency of the wall heating. In ovens having double separated wall heating channel systems in each partition wall, and while the upper horizontal connecting channels were, up to the present time, placed above the top of the oven chamber, these channels are by this inventor placed below the top on the sides.

537,872—April 23, 1895. CHARLES H. VANNIER. *Coke oven.*

Claims a coking oven having a dome-shaped top and flat bottom, a series of straight horizontal flues arranged beneath the bottom and communicating, with a common transverse flue, a series of straight vertical flues in the rear wall, each vertical flue having direct communication with two of said horizontal flues, the inclined flues leading from the tops of the vertical flues into the oven, and one or more inclined air-passages leading into each vertical flue.

551,113—December 10, 1895. NILS KARL HERMAN EKELUND. *Apparatus for manufacturing coal powder from peat, etc.*

Claims in a coking apparatus for manufacturing coal powder of peat, sawdust, and the like, the combination of a zigzag-shaped drying and coking conduit, provided with transport screws for moving the mass, a heating canal extending beneath and along said conduit, this canal communicating below with a fireplace; a compartment, forming a part of the conduit and situated at a distance from one end of the same, feeding rollers situated in the compartment, and a damper serving to regulate the feeding so as to maintain the compartment filled with the mass, whereby the conduit is divided into two divisions, viz, one upper division for the drying and one lower division for the coking.

568,074—September 22, 1896. FRANK L. SLOCUM. *Coke oven.*

Claims a longitudinally extending coke oven having heating flues in the side walls thereof and having the side walls between the coking chambers and flues formed of vertical slabs with horizontally and inwardly extending flanges above and below the flues, and horizontal tiles forming tile plates between the vertical slabs extending into the central wall beyond the slabs.

568,075—September 22, 1896. FRANK L. SLOCUM. *Coke oven.*

Claims a bank of coke ovens having longitudinally extending coking chambers, combustion and heating flues in the bottom and side walls thereof, and a series of longitudinally extending waste product flues and air heating flues alternating with each other and filling the space under the coke oven, a gas producer communicating with the combustion flue of the coke oven, the bottom air heating flues of said series leading to the gas producer, and the other air heating flues passing between the waste product flues and opening into the combustion flue under the coking chamber.

582,491—May 11, 1897. HUGO STINNES. *Coke furnace.*

Consists in building up the coking chamber with heating flues at the bottom and at the sides and in providing such air admitting and air heating flues that the best utilization of the heating gas is obtained and that the flues during the process may be controlled and inspected, and finally, that repairs in the most exposed parts of the interior of flues and distilling chamber may be made without disturbing the neighboring parts in the furnace and in the flues and without necessitating the pulling down of other parts of the furnace.

607,437—July 19, 1898. LOUIS J. HIRT. *Coking oven.*

Claims a coking oven comprising a retort, a series of substantially horizontal flues arranged one above the other on opposite sides of the retort and extended substantially the length of the retort to form a continuous passage for the heat from end to end of the retort, vertical flues communicating with said horizontal flues at the opposite ends of the same, substantially horizontal flues communicating with the end flues and extended below the sole of the retort toward its center, and regenerators connected to said sole-heating flues.

615,709—December 13, 1898. ALBERT HÜSSENER AND LOUIS HOLBECK AND JOSEPH KIRSCHFINK. *Horizontal coke oven.*

Claims in horizontal coke ovens for recovering by-products having partition walls between the coking chambers and a separate system of zigzag flues at either side of each of the said chambers, the combination of a duplex subsole flue having each of its members separately and independently communicating with one of the said lateral flue systems, each of these members being connected to one uptake of each side wall flue system and of a series of auxiliary air channels lying between the lowest waste heat flues in the lowest part of the foundation of the oven, extending with both ends through the front walls of the ovens—one end of these channels leading to the open air for the reception of cold air and the other end communicating with the pipes for leading the heated air to the gas supply—entering the heating flues for the purpose of combustion therewith.

624,173—May 2, 1899. ALBERT CAMPBELL. *Fuel.*

Claims an improved fuel, consisting of coke, the lumps or pieces of which have smooth external surfaces.

627,043—June 13, 1899. JOHN BOWING. *Process of and apparatus for coking.*

Claims the process of coking refractory coal, which consists in placing the coal in a finely divided and wet condition in a closed retort, raising the temperature rapidly until the coking temperature is reached, and maintaining the temperature of the coal without fluctuations until the coking is complete, and conducting the gases produced during the coking of the coal to the coal to be afterwards acted upon, to enrich it; and,

A coking oven provided with a vertical retort of metal, a muffle of nonheat-conducting material surrounding said retort for protecting the same, but separated therefrom by an intervening annular space, a circular flue surrounding said muffle and passages for conducting the products of combustion to the flue, the combined sectional area of said passages being equal to the sectional area of said flue, whereby fluctuations in the temperature of the retort and contents are prevented.

632,116—August 29, 1899. LOUIS J. HIRT. *Coking oven.*

Claims the combination with a coking oven provided with a series of retorts having a series of heating flues, of generators located on substantially the same level as the coking oven and provided with outlet pipes or flues extended on opposite sides of the coking oven and communicating with the heating flues, and gas supply pipes extended on opposite sides of the coking oven and communicating with said heating flues.

644,369—February 27, 1900. FREDERIC W. C. SCHNIEWIND. *Regenerative coke oven.*

Claims in combination with a bank of coke ovens having regenerators for preheating the air and to support combustion by the waste heat of the furnaces used for heating the ovens, a system of cooling flues situated in the masonry beneath the ovens and furnaces, a collecting fan for drawing air through said flues, and a discharge conduit from said fan connecting with the air-supply pipes leading to the regenerators.

649,450—May 15, 1900. GUSTAV HILGENSTOCK. *Coke oven.*

Claims in combination with a series of horizontal externally heated coke ovens arranged side by side and having heating flues arranged in their partition walls and discharging openings at their ends, a series of parallel tunnels, of size sufficient to permit the passage of a man, arranged beneath the ovens and heating flues and parallel with the ovens, gas conduits running through and accessibly situated in said tunnels and a series of burner pipes extending from different points along the length of each of said conduits into the heating flues.

649,483—May 15, 1900. OTTOMAR RUPPERT. *Externally heated coke oven.*

Claims in combination with a series of horizontal coke ovens arranged to receive heat through their walls and for the saving of by-products, two separate and relatively independent combustion chambers situated one above the other between the walls of adjacent ovens, separate air and gas supplies entering each combustion chamber and a common flue system also situated between the adjacent ovens connected with but not passing through the combustion chambers.

654,036—July 17, 1900. ROBERT E. LAUCK. *Retort furnace.*

Claims in a retort furnace, a retort having its front end projecting through the furnace wall, and comprising a casing having an inlet port near one end and an outlet port at the other, and provided with an internal comb, a perforated partition at the front end of the comb and furnace, a nonconductor of heat filling the casing forward of the partition, and a shaft journaled in the casing and extending through the partition and provided with a skeleton spiral conveyor, the teeth of which pass between those of the comb.

654,307—July 24, 1900. EVENCE COPPÉE. *Coke oven.*

The object of this invention is to provide an oven in which the gases may be introduced into the lower parts thereof and principally under the bottom of the oven chamber, so that the greatest heat may be produced in these lower parts and the heat in the upper parts will not be great enough to decompose the light oils which are evolved from the coal in the oven. It also aims to distribute the inlets for the gases and air, so as to have uniform heat in the middle and at the ends of the oven, and to provide means for dividing and controlling the draft in the flues of the oven and to separately regulate the draft of the gases and of the air introduced at the front and at the back of the oven into these flues, and the inventor claims a particular arrangement of chambers, openings, and flues.

656,893—August 28, 1900. JEANNOT W. KENEVEL. *Apparatus for treating coal and ores.*

Claims in an apparatus of the kind described, the combination of a horizontally arranged retort having means for charging and discharging the same, a combustion chamber beneath the retort, a substantially vertical flue communicating with the combustion chamber and arranged at the side of the retort for heating the same, an elongated horizontal flue located adjacent said retort and combustion chamber and communicating by means of a return flue with said vertical flue, a steam heating pipe in said horizontal flue, and connection from the same into the retort.

659,046—October 2, 1900. CHRISTOPHER G. ATWATER. *Coking oven.*

Claims in a coke oven, a coking space shaped like a truncated wedge, base upward, horizontal fire brick passages under each other fitted to the sides of said wedge, so as to widen downward in proportion as the coking space narrows, and burners for introducing gas into said passages at intervals.

663,638—December 11, 1900. HEINRICH POETTER. *Coke oven.*

Claims the combination of coke oven, heating chamber, partitions in the heating chamber, nozzles in the top of chamber above partitions, gas pipe communicating with the nozzles, means for supplying gas to both ends of pipe, an air chamber above the oven, and air passages beside the nozzles and inclined toward each other, so that the air and gas currents meet and commingle above partitions.

668,225—February 19, 1901. FREDERIC W. C. SCHNIEWIND. *Apparatus for manufacturing gas.*

Claims the combination with a multiple series of carbonizing chambers and a common gas collecting main receiving gas therefrom, of gas furnaces arranged to heat the carbonizing chambers, a gas purifying plant connected to the common collecting main and a gas conduit leading from the purifying plant to the gas furnaces and inclosing the gas collecting main aforesaid, whereby the gas coming from the carbonizing chambers is cooled in the collecting main, then purified, then reheated, and then burned in the furnaces.

668,402—February 19, 1901. PORT B. ELKINS. *Coking furnace.*

Claims a coking furnace of heating walls suitably spaced with reference to the formation of coking chambers between adjacent walls, each wall for its entire length, or approximately so, being provided with two series of vertical flues and with two horizontal flues, each connected with the upper ends of one series of vertical flues, and two combustion chambers, each connected to the lower ends of one-half, more or less, of both series of vertical flues.

673,928—May 14, 1901. FREDERIC WILLIAM CHARLES SCHNIEWIND. *Regenerative coke oven.*

Claims a series of coke ovens with heating flues situated between adjacent ovens built up of masonry supported above the ground on metal columns in combination with a pair of regenerators connected with the heating flues of the ovens, said regenerators being situated beneath the ovens and supported on the ground independently of the columns.

679,749—August 6, 1901. LOUIS J. HIRT. *Coke oven.*

Claims in a coking oven, the combination with a vertically arranged oven provided with vertically arranged partition walls separating the said oven into a series of chambers which communicate at their upper ends with a common passage extended across the tops of said chambers, a fuel inlet for said chambers, and a coke outlet for said chambers at their lower ends, substantially horizontal superimposed flues in the opposite side walls of said oven connected at their opposite ends to form a continuous passage, which communicates with the atmosphere at the lower end of said passage, a gas inlet communicating with the said flues at an intermediate point and with the gas outlet for said oven, and means to control the communication of said gas inlet with said gas outlet.

682,441—September 10, 1901. SAMUEL T. WELLMAN AND CHARLES H. WELLMAN. *Coke oven.*

This invention is based upon the discovery that magnesite or carbonate of magnesia (calcined) made into bricks has a very much higher conductivity as a carrier of heat than either clay or silica bricks, having on an average about twice the conductivity of either of the latter. This would be a particularly desirable material from which to form the walls of retort coke ovens; but, unfortunately, these bricks when heated to a high temperature have little strength, will not carry much weight, and under the influence of high temperature are apt to shrink considerably. Consequently, if the inner walls of the ovens were formed entirely of this material, the oven would soon get out of shape, the gases would leak through the walls, and in a short time the ovens would be of such shape that they could not be used at all. To obviate the objections due to its shrinkage and inferior strength when heated, bricks made of magnesite or magnesia are employed in conjunction with clay or silica bricks, or bricks formed of a mixture of magnesite or magnesia with clay or silica are used.

705,446—July 22, 1902. MATHEW E. ROTHBERG. *Coke oven.*

Claims in adjacent coking ovens, a hollow longitudinal wall separating the oven chambers, and longitudinal deflecting partitions forming heating or combustion flues in the cavity or chamber of said wall, and a vertical hot-air flue at the outer ends of said combustion flues, the inner wall of which air flue is pierced for passage of air to the combustion flues.

711,268—October 14, 1902. JOHN F. WILCOX AND DIETRICH E. WAGENER. *Retort coke oven.*

Claims the combination of by-product retort coking ovens heated by gas in the presence of heated air, a hot-air intake flue extending transversely above the ovens and provided with lateral branches lying over the ovens, and combustion chambers contiguous to the upper part of the oven, whereby the expansion due to heat in the flue and chamber may take place without injury to the retorts.

718,027—January 6, 1903. MATHEW E. ROTHBERG. *Coke oven.*

In adjacent coke ovens, a hollow bottom, partitions in the cavity of said bottom and forming transverse reverting combustion flues, a hollow wall separating the oven chambers, a transverse partition dividing the cavity of said wall into two compartments, partitions forming longitudinal reverting combustion flues in said compartments, a reverting hot-air flue leading to said transverse flues, a horizontal draft flue, a hot-air chamber surrounding said draft flue, a hot-air pipe communicating with said reverting hot-air flue, and with said hot-air chamber, said longitudinal combustion flues communicating at one end thereof with said transverse flues, and at the other end thereof with the draft flue.

720,971—February 17, 1903. MATHEW E. ROTHBERG. *Coke oven.*

Claims in adjacent open-end coking ovens, a hollow longitudinal wall separating the oven chambers, longitudinal deflecting partitions forming reverting combustion flues in the cavity or chamber of said wall, alternate partitions having openings therethrough forming short-circuiting passages connecting said flues, and provided with sliding valves, the oven wall having an opening adjacent to each such valve, and plugs for closing such openings.

725,748—April 21, 1903. EDWIN A. MOORE. *Foundation or substructure for coke oven.*

Claims a foundation or substructure for coke ovens, comprising a floor, girders and joists of metal embedded in concrete, and columns of concrete, in combination with metallic tie rods between the girders and the columns.

725,749—April 21, 1903. EDWIN A. MOORE. *Means for protecting coke ovens.*

Claims a coke oven having its sides incased in metallic sections provided with recesses in the rear sides thereof, and heat-nonconducting material in said recesses.

731,088—June 16, 1903. MAHLON UPDIKE. *Retort coke oven.*

Claims in an apparatus of the kind described, a closed retort provided with means for conducting the gases and vapors therefrom and means for charging and discharging the same, and having side walls composed of sectional flue-tiling, the openings through which form oppositely arranged continuous serpentine flues for conducting the products of combustion in close proximity to the retort, a main flue connecting with the inner ends of said flues, and a combustion chamber connecting with the outer ends of the same, in combination with a burner arranged in said combustion chamber and constructed to drive the products of combustion into and through said flues.

731,950—June 23, 1903. JOHN A. POTTER. *Coke oven and gas producer.*

Claims a coke and gas producer of vertical stack form arranged to contain a vertical charge, regenerative flues around its lower portion having gaseous inlets and arranged to heat said gases, a gas offtake at the upper end of the producer and mechanism at the bottom of the producer arranged to shear off and discharge successive portions of the charge.

738,918—September 15, 1903. HEINRICH KOPPERS. *Regenerative coke oven.*

Claims improvement in regenerative coke ovens comprising, in combination with the usual coking chambers and the heating flues, gas regenerators and air regenerators below said coking chambers and heating flues, gas distributing channels below the bottom of the heating flues, air distributing channels below the ovens and with which the air regenerators communicate, covering arches above the heating flues, vertical borings in the bottom of the heating flues placed perpendicularly below the openings in the covering arches of the heating flues, said vertical borings communicating with the gas distributing channels, removable nozzles in said borings, recesses in the side walls of the heating flues close to the bottom of the same, horizontal borings in the side walls of the air channels connecting the same with the recesses in the side walls of the heating flues, nozzles in said horizontal borings, openings in the top wall of the oven above the gas channels at the upper end of the heating flues and removable cover plates closing said openings in the top wall of the oven.

753,146—February 23, 1904. HEINRICH KOPPERS. *Coke oven.*

Claims a coke oven comprising in combination with the usual coking chambers and the heating flues, provided with nozzles at the bottom for the admission of a vertically ascending gas column, inclined channels connecting the air conduits with the base part of the heating flues, the inclination being out of line with the ascending gas column in order to leave it undisturbed and to circulate around it.

754,459—March 15, 1904. ANTHONY C. KLOMAN. *Retort for making gas and coke.*

Claims a coke retort chamber having means for applying heat thereto, said chamber having a bottom inclined in both directions from a middle angular ridge and discharge openings at the ends of said inclined bottoms, the tops of said openings extending to a level above the ridge, and doors closing said discharge openings.

761,789—June 7, 1904. CARL SCHROETTER. *Coke oven.*

This invention relates to improvements in coke ovens of that general type wherein the oven comprises within a single external housing or casing a series of similarly arranged and equipped retorts adapted to treat independent quantities of coal supplied thereto, the several retorts being adapted to effect the coking action solely through the application of external heat, the coking action not being dependent upon heat furnished by combustion within the retorts; and,

The inventor claims in a coke retort of the character specified the top and side walls whereof are formed with an intermediate checkerwork through which the burning fuel and hot products of combustion are circulated, the combination with a combustion chamber directly beneath the sole of the retort, of means for introducing fuel with air under pressure to support combustion directly into the combustion chamber and other means for introducing fuel with air under pressure to support combustion directly into the checkerwork of the side walls.

766,898—August 9, 1904. HEINRICH POETTER. *Horizontal coke oven.*

According to this invention the heating gases are conducted simultaneously from both oven crowns below on each side by a lateral piping and two branched-off gas pipes or more into two or several gas dividing ports, which are disposed below each other, so as to be mutually quite independent. From said gas dividing ports the heating gases pass through vertical nozzles in the heating or combustion ports, in which they become mixed with strongly heated air and are then burned, whereby said gases during their ascension heat one-fourth or less of the oven wall. Owing to this division or distribution of the heating gases into two or several spaces which are completely separated or independent from each other, the result is obtained that said gases flow out from all nozzles with the same pressure, so that all the combustion ports are uniformly heated.

769,531—September 6, 1904. EWALD BREMER. *Oven for coking peat with recovery of by-products.*

Claims an oven for coking peat, comprising a vertically disposed retort, a preliminary drier on the upper end of the retort, adapted to discharge its contents into the retort, a cooling or condensing box at the lower end of the said retort, for receiving the coked peat from the retort, a vertically arranged collecting chamber in the wall of the retort and in communication therewith, for collecting the gases arising in the retort, a gas receiver communicating with the upper end of the collecting chamber, and a combustion chamber in the wall of the retort for burning the said gases after they are regenerated and mixed with air.

770,151—September 13, 1904. THEODOR BAUER. *Coke oven.*

Claims in a battery of adjacent coke ovens, the combination with a plurality of ovens, of a plurality of heating chambers, two on both sides of each oven, each divided by partitions into a plurality of groups of vertical flues, a plurality of air-heating chambers, one between two adjacent heating chambers and one on the side of the external heating chambers of the end ovens, each divided by partitions into a plurality of groups of vertical channels which communicate with the atmosphere by openings and with the flues of the adjacent heating chambers by holes, three main mixing channels placed in the longitudinal direction of the battery above the ovens and the heating chambers and communicating therewith, means for closing and opening the three main mixing channels to the ovens and the heating chambers, means for arbitrarily exhausting the gases from the ovens, a condensing apparatus for purifying the exhausted gases, three tubes with branches for conducting a part of the purified gases from the condensing apparatus to the three main mixing channels, a steam source, means for injecting the purified gases from the branches of the three tubes by means of steam from the steam source into the three main mixing channels, a plurality of horizontal heating flues, one beneath each oven and divided by one partition into halves which communicate with the last flues of the adjacent vertical heating chambers by slots, a plurality of horizontal cooling channels, one beneath each horizontal heating flue and divided by partitions into several parts which communicate by holes with one adjacent air-heating chamber for preliminarily heating the air, two main collecting flues placed along the two longitudinal battery sides and leading to boilers or the like and to a chimney, a plurality of descending flues connecting the horizontal heating flues with the main collecting flues, a plurality of communicating channels connecting the three main mixing channels with each other, a plurality of descending channels connecting the communicating channels with the two main collecting flues, and means for regulating the escape of any excess of gases or mixture from the main mixing channels to the main collecting flues.

782,259—February 14, 1905. CLYDE S. MASON. *Retort coke oven.*

Claims in a retort coking oven, the combination of a series of horizontal retort ovens, combustion chambers below the same, vertical heating flues arranged between adjacent ovens and communicating at their lower ends with the combustion chambers, and a plurality of horizontal flues between adjacent ovens, one of said flues communicating with the upper ends of the vertical flues and another of said flues extending from side to side of the series of ovens, the wall or walls separating said horizontal flues being provided with openings for equalizing the flow of the gases.

793,260—June 27, 1905. MARTIN ZIEGLER. *Kiln for coking peat or similar material.*

Claims a furnace for coking peat and the like having an upright retort of oval or elongated form in cross section and superposed partitions arranged near to the end walls in the interior of the retort, each partition being situated nearer to the end wall of the retort than the one above it, in such a manner that openings are formed between the partitions.

794,662—July 11, 1905. EVENCE COPPÉE. *Coke oven.*

Claims in combination with a series of horizontal externally heated coke ovens, which can be worked with or without recovery of by-products, and having walls constructed similarly in the front and rear of the ovens, gas return passages beneath the ovens distributing the mixture of gas and air arriving from the walls of two contiguous ovens, in variable and adjustable proportions according to the necessities of the working, one part under the floor of one of said ovens and the other part under the floor of the neighboring oven.

797,703—August 22, 1905. FRANZ PALLENBERG AND FRIEDRICH WILHELM SANDMANN. *Coking oven.*

Claims in a coking oven the combination of vertical flues, gas distributing channels beneath the said flues, jets for feeding gas to the said flues, passages parallel to the gas distributing channels, means adjustable from said passages for introducing air into the flues, openings connecting the said flues and passages and rendering the said jets accessible, and means for closing the said openings.

798,086—August 29, 1905. GUSTAV WOLTERS. *Coking furnace.*

Claims in a coking oven, having a series of alternately operated regenerators and alternately operated gas feeds, the combination of a series of chambers formed in the oven walls and means for alternately feeding live gas and air to certain of these chambers in each wall, means for feeding the gases of combustion to the intermediate chambers of the same wall, to which said chambers the live gas was not fed, and means for simultaneously withdrawing waste gas from the latter chambers and vice versa.

804,053—November 7, 1905. MATHEW E. ROTHBERG. *Coke oven.*

Claims a coking oven having in combination a series of adjacent coking chambers, reverting heating flues in the side walls of the coking chambers, a transverse stack draft flue in the foundation at one end of said heating flues, vertical off-gas flues connecting said stack draft flue with said heating flues, a transverse air supply flue in the foundation parallel to said stack draft flue and at the other end of said heating flues, and combustion chambers under the ovens and having connection with said air supply flue.

804,054—November 7, 1905. MATHEW E. ROTHBERG. *Coke oven.*

Claims in double front coke ovens, the combination of hollow longitudinal walls having each a median transverse partition, a set of vertical updraft heating flues and a set of vertical downdraft heating flues upon each side of said partition and extending from front to middle of the ovens, a chamber above each double set of said heating flues and into which they open, said chamber extending from front to middle of the ovens, combustion chambers under the ovens having communication with said updraft heating flues, a common central off-gas flue in the foundation having connection with the downdraft heating flues, and air passages in the foundation having connection with said combustion chambers.

807,532—December 19, 1905. VINCENT G. APPLE. *Coke and gas plant.*

Claims a coke and gas plant comprising two batteries of retorts arranged side by side in lateral alignment, a source of power supply arranged in the space between said batteries, a source of material supply, and means comprising a single continuously operable equipment of transfer devices extending laterally of the retort batteries and said source of material supply for constantly conveying material to the retort, and operating connections between said transfer devices and the source of power.

PETROLEUM REFINING

PETROLEUM REFINING.

By Charles E. Munroe, Professor of Chemistry, George Washington University, Expert Special Agent.

This report deals with those manufacturing establishments in which a variety of marketable products are produced by the treatment of crude petroleum. Establishments which purchase refined or partly refined petroleum products and mix or compound them with vegetable, animal, or mineral oils, or other substances, in order to produce a special composition are not included in this category. Statistics of this industry were first collected in 1880 and were treated in a special report, but they were not then included in the Report on Manufactures. At the censuses of 1890 and 1900 this industry was treated as manufacturing, and it was so considered at the census of 1905. It has been the endeavor to prepare the schedules of inquiry and to compile the tables of results in such a manner that the data for each census are comparable with those for the one preceding.

Table 1 presents the general statistics for the establishments engaged actively in petroleum refining at the censuses from 1880 to 1905, with the amount and per cent of increase in each item for the several periods considered.

Table 1.—COMPARATIVE SUMMARY, WITH AMOUNT AND PER CENT OF INCREASE: 1880 TO 1905.

	CENSUS.				INCREASE.			PER CENT OF INCREASE.				
	1905	1900	1890	1880	1900 to 1905	1890 to 1905	1880 to 1905	1900 to 1905	1890 to 1905	1880 to 1905	1890 to 1900	1880 to 1890
Number of establishments	98	[1] 67	[2] 94	86	31	4	12	46.3	4.3	14.0	[3] 28.7	9.3
Capital	$136,280,541	$95,327,892	$77,416,296	$27,325,746	$40,952,649	$58,864,245	$108,954,795	43.0	76.0	398.7	23.1	183.3
Salaried officials, clerks, etc., number	1,974	1,201	[4] 1,068		773	906		64.4	84.8		12.5	
Salaries	$2,724,065	$1,811,400	[4] $1,117,011		$912,665	$1,607,054		50.4	143.9		62.2	
Wage-earners, average number	16,770	12,199	11,403	9,869	4,571	5,367	6,901	37.5	47.1	69.9	7.0	15.5
Total wages	$9,989,367	$6,717,087	$5,872,467	$4,381,572	$3,272,280	$4,116,900	$5,607,795	48.7	70.1	128.0	14.4	34.0
Men 16 years and over	16,256	11,935	10,885		4,321	5,371		36.2	49.3		9.6	
Wages	$9,832,124	$6,673,629	$5,786,737		$3,158,495	$4,045,387		47.3	69.9		15.3	
Women 16 years and over	82	66	2		16	80		24.2	4,000.0		3,200.0	
Wages	$26,117	$15,570	$622		$10,547	$25,495		67.7	4,098.9		2,403.2	
Children under 16 years	432	198	516		234	[3] 84		118.2	[3] 16.3		[3] 61.6	
Wages	$131,126	$27,888	$85,108		$103,238	$46,018		370.2	54.1		[3] 67.2	
Miscellaneous expenses	$5,297,508	$3,330,851	$2,069,268	([5])	$1,966,657	$3,228,240		59.0	156.0		61.0	
Cost of materials used	$139,387,213	$102,859,341	$67,918,723	$34,999,101	$36,527,872	$71,468,490	$104,388,112	35.5	105.2	298.3	51.4	94.1
Value of products	$175,005,320	$123,929,384	$85,001,198	[6] $43,705,218	$51,075,936	$90,004,122	$131,300,102	41.2	105.9	300.4	45.8	94.5

[1] Exclusive of 2 idle establishments, with aggregate capital amounting to $90.000.
[2] Exclusive of 7 idle establishments, with aggregate capital amounting to $423,503.
[3] Decrease.
[4] Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905, but not included in this table.
[5] Not reported.
[6] Does not include the value of packages made at the refinery.

The term "capital" as used in Table 1 refers only to the sum invested in lands, buildings, machinery, tools, and implements, and the funds required to carry on the business, and does not include capital stock.

The various classes of wage-earners were divided as follows in 1905: Men, 96.9 per cent; women, five-tenths of 1 per cent; children, 2.6 per cent. In 1900 the proportions were 97.8 per cent for men, six-tenths of 1 per cent for women, and 1.6 per cent for children; while in 1890 they were 95.5 per cent for men, less than one-tenth of 1 per cent for women, and 4.5 per cent for children.

Table 2 shows, by states, the number of refineries in operation at each census from 1880 to 1905.

Table 2.—*Number of active refineries, by states: 1880 to 1905.*

STATE.	1905	1900	1890	1880
United States	104	75	106	89
California	19	4	2	
Colorado	2	2	2	
Indiana	1	1		
Kansas	1	1		
Kentucky				1
Louisiana	1			
Maine				1
Maryland	1	1	3	3
Massachusetts			1	5
Michigan		1		
New Jersey	6	6	5	2
New York	9	9	16	21
Ohio	12	9	15	18
Pennsylvania	43	39	58	33
Texas	7	1		
West Virginia	1	1	4	5
Wyoming	1			

The total number of refineries shown in Table 2 differs from the total number of establishments shown for the same census in Table 1. This difference is due to the fact that when two or more refineries in the same city or county are operated by one corporation, firm, or individual, they are considered by the Bureau of the Census as one establishment. The total number of refineries in operation at the different censuses has fluctuated, the number in 1905 being 29, or 38.7 per cent, greater than in 1900; 2, or 1.9 per cent, less than in 1890; and 15, or 16.9 per cent, greater than in 1880.

In 1905 there were 104 refineries distributed among 13 states; in 1900, 75 refineries in 12 states; in 1890, 106 refineries in 9 states; and in 1880, 89 refineries in 9 states. In 1905 Louisiana and Wyoming were added to the list of states in which petroleum is refined. In 4 states—California, Ohio, Pennsylvania, and Texas—the number of refineries in operation in 1905 was greater than in 1900. No refinery was reported in 1905 for Michigan, where 1 was in operation in 1900.

Pennsylvania ranked first in the number of refineries in 1905, a position which this state has held since 1880, when the statistics of this industry were first collected. California, for which statistics were first reported in 1890, ranked second in 1905, displacing Ohio and New York, which jointly held this rank in 1900. Ohio was third, New York fourth, Texas fifth, and New Jersey sixth. In none of the other states were more than 2 refineries in operation in 1905.

Table 3 gives, for the censuses from 1890 to 1905, the details of the capital for the active establishments in the United States, with the amount and per cent of increase; also the number of stills.

TABLE 3.—CAPITAL, WITH AMOUNT AND PER CENT OF INCREASE: 1890 TO 1905.

	CENSUS.			INCREASE.		PER CENT OF INCREASE.		
	1905	1900	1890	1900 to 1905	1890 to 1905	1900 to 1905	1890 to 1905	1890 to 1900
Number of establishments	98	[1] 67	[2] 94	31	4	46.3	4.3	[3] 28.7
Number of stills	1,907	1,774	1,275	133	632	7.5	49.6	39.1
Capital	$136,280,541	$95,327,892	$77,416,296	$40,952,649	$58,864,245	43.0	76.0	23.1
Land	$10,221,401	$8,166,032	$7,886,668	$2,055,369	$2,334,733	25.2	29.6	3.5
Buildings	$9,389,369	$6,502,182	$6,403,994	$2,887,187	$2,985,375	44.4	46.6	1.5
Machinery, tools, and implements	$53,223,807	$39,565,389	$20,837,038	$13,658,418	$32,386,769	34.5	155.4	89.9
Cash and sundries	$63,445,964	$41,094,289	$42,288,596	$22,351,675	$21,157,368	54.4	50.0	[3] 2.8

[1] Exclusive of 2 idle establishments, with aggregate capital amounting to $90,000.
[2] Exclusive of 7 idle establishments, with aggregate capital amounting to $423,508.
[3] Decrease.

Some fluctuation is shown in the number of establishments and in the amount of capital represented by the item "cash and sundries." Every other item in the table shows a steady increase.

Table 4 shows the per cent distribution of capital.

TABLE 4.—*Per cent distribution of capital: 1890 to 1905.*

	1905	1900	1890
Capital	100.0	100.0	100.0
Land	7.5	8.6	10.2
Buildings	6.9	6.8	8.3
Machinery, tools, and implements	39.0	41.5	26.9
Cash and sundries	46.6	43.1	54.6

The proportion of the capital invested in land has decreased steadily. The proportion invested in buildings has decreased since 1890, but was nearly constant at the last two censuses. The proportion invested in machinery, tools, and implements has fluctuated, but was larger in 1905 than in 1890. The proportion of the capital credited to cash and sundries constituted the largest item at each census. It has fluctuated from census to census, but was smaller in 1905 than in 1890.

Table 5 shows the kind, quantity, and cost of the materials used for each census from 1880 to 1905, with the amount and per cent of increase.

TABLE 5.—MATERIALS USED, WITH AMOUNT AND PER CENT OF INCREASE: 1880 TO 1905.

	CENSUS.				INCREASE.			PER CENT OF INCREASE.				
	1905	1900	1890	1880	1900 to 1905	1890 to 1905	1880 to 1905	1900 to 1905	1890 to 1905	1880 to 1905	1890 to 1900	1880 to 1890
Materials used, total cost	$139,387,213	$102,859,341	$67,918,723	$34,999,101	$36,527,872	$71,468,490	$104,388,112	35.5	105.2	298.3	51.4	94.1
Crude petroleum:												
Quantity (barrels of 42 gallons)	66,982,862	52,011,005	30,662,629	17,417,455	14,971,857	36,320,233	49,565,407	28.8	118.5	284.6	69.6	76.0
Cost	$107,487,091	$80,424,207	$44,879,783	$16,340,581	$27,062,884	$62,607,308	$91,146,510	33.7	139.5	557.8	79.2	174.7
Fuel	[1] $5,139,934	$3,120,441	$2,275,468	$1,319,008	$2,019,493	$2,864,466	$3,820,926	64.7	125.9	289.7	37.1	72.5
Acids	$2,304,635	$1,735,782	$1,530,065	$1,206,300	$568,853	$774,570	$1,098,335	32.8	50.6	91.0	13.4	26.8
Barrels, cases, and tin cans (purchased)	$5,880,310	$2,930,805	$4,340,274	$8,388,572	$2,949,505	$1,540,036	[2] $2,508,262	100.6	35.5	[2] 29.9	[2] 32.5	[2] 48.3
Coopers', carpenters', and tinners' materials	$11,990,038	$8,220,928	$12,495,600	$7,576,055	$3,769,110	[2] $505,562	$4,413,983	45.8	[2] 4.0	58.3	[2] 34.2	64.9
Mill supplies	$403,886	$228,926	(3)	(3)	$174,960			76.4				
All other materials	$5,666,501	$3,300,851	[4] $2,397,533	$168,585	$2,365,650	$3,268,968	$5,497,916	71.7	136.3	3,261.2	37.7	1,322.2
Freight	$514,818	$2,897,401	(3)	(3)	[2] $2,382,583			[2] 82.2				

[1] Includes $3,668 for rent of power and heat.
[2] Decrease.
[3] Not reported separately.
[4] Includes $127,205, the value of residuum and naphtha used as materials.

The total cost and quantity of crude petroleum used at each census has increased steadily, though not in the same proportion for each. The increase in cost for 1890 over 1880 was $28,539,202; for 1900 over 1890, $35,544,424; and for 1905 over 1900, $27,062,884. The increase in quantity for 1890 over 1880 was 13,245,174 barrels; for 1900 over 1890, 21,348,376 barrels; and for 1905 over 1900, 14,971,857 barrels. While in commerce crude petroleum is measured by barrels of 42 United States (Winchester) gallons, refined petroleum is measured by barrels of 50 United States gallons.[1]

Under the term "acids," as used in Table 5, were included at each census a number of different chemical substances. In 1905 the term included sulphuric acid, alkali, sulphur, and pyrites; in 1900, acids, alkalies, and sulphur; in 1890, sulphuric and all other acids; and in 1880, sulphuric acid, hydrochloric acid, and sulphur. In 1905 the quantity of sulphuric acid used in refining the crude petroleum was reported in two items—162,152 short tons were purchased and 49,379 short tons were produced in the refineries and consumed in refining. In all, 211,531 tons, or 423,062,000 pounds, were used. In 1890, 95,916 tons, or 191,832,000 pounds, were used; and in 1880, 45,820 tons, or 91,640,000 pounds. No separate returns were secured for this item at the census of 1900. The quantity of sulphuric acid used in refining in 1905 was 115,615 tons, or 120.5 per cent, greater than in 1890, and 165,711 tons, or 361.7 per cent, greater than in 1880. In 1905, 1 pound of sulphuric acid was used to 6.6 gallons of crude petroleum; in 1890, 1 pound to 6.7 gallons; and in 1880, 1 pound to 8 gallons.

In the case of many of the returns the cost of freight is included in the cost given for the separate items of materials used.

[1] As a gallon of the crude petroleum found in the United States varies in weight from 6.41 to 7.83 pounds, the oil in a barrel varies from 269.22 to 328.86 pounds.

At each census the cost of the crude petroleum has formed the largest proportion of the total cost of materials used, although in 1880 it exceeded that for containers by only 1.1 per cent. In 1880 it formed 46.7 per cent of the total cost; in 1890, 66.1 per cent; and in 1900, 78.2 per cent; but in 1905 it fell to 77.1 per cent. The cost of containers, as set forth in Table 5, embraces two items: First, the packages purchased, such as barrels, tin cans, and cases; and second, the coopers', carpenters', and tinners' materials, from which containers are manufactured within the establishments. Evidently the final cost of the containers made from the last enumerated materials would be greater by the cost of the labor, fuel, and the like expended upon them. These items of cost appear in totals in their assigned places in Table 1 and Table 5. There is no information at command which permits of their being apportioned to their several duties.

The proportion which the cost of fuel formed of the total cost of materials used at the different censuses was: In 1880, 3.8 per cent; in 1890, 3.3 per cent; in 1900, 3 per cent; and in 1905, 3.7 per cent—the average for the four censuses being 3.4 per cent. The proportion of acids decreased from 3.4 per cent in 1880 to 1.6 per cent in 1900. The proportion of "all other materials" increased steadily from five-tenths of 1 per cent in 1880 to 4.1 per cent in 1905.

The combined amount of the total cost of materials used and total wages was: At the census of 1880, $39,380,673; of 1890, $73,791,190; of 1900, $109,576,428; and of 1905, $149,376,580. The proportion which the cost of the crude petroleum used bore to this combined total was: At the census of 1880, 41.5 per cent; of 1890, 60.8 per cent; of 1900, 73.4 per cent; and of 1905, 72 per cent. The proportion which the total wages bore to this combined total was: At the census of 1880, 11.1 per cent; of 1890, 8 per cent; of 1900, 6.1 per cent; and of 1905, 6.7 per cent.

Table 6 presents statistics concerning the equipment of plants by states in 1890, 1900, and 1905.

TABLE 6.—EQUIPMENT OF PLANT, BY STATES: 1890 TO 1905.

STATE.	Census.	BUILDINGS. Cooper shops.	BUILDINGS. Tin-smith shops.	Stills. Heated by steam.	Stills. Heated by super-heated steam.	Stills. Heated by fire.	Agitators.	Chilling houses for paraffin.	POWER. Total horse-power.	Engines. Steam.	Engines. Gas and gasoline.	Electric motors.	Pumps, etc., and allied equipments.	Presses.	STORAGE TANKS.[1] For crude petroleum.	STORAGE TANKS.[1] For refined petroleum.
United States	1905	64	17	282	15	1,610	374	67	49,337	1,072	57	224	41	311	304	3,575
	1900	48	13	290	26	1,458	327	48	37,052	864	28	69	[2] 194	510	257	2,869
	1890	31	20	217	61	997	306	39	36,281	545	(3)	(3)	(3)	767	292	1,861
California [4]	1905	11	2	14	....	92	47	1	1,323	25	1	6	15	2	43	375
	1900	2	1	9	6	22	7	1	180	4	1	....	20	2	12	62
New Jersey	1905	5	5	33	....	339	52	3	10,659	172	1	31	....	34	27	400
	1900	9	4	42	8	303	64	10	12,048	121	....	27	129	123	32	497
	1890	4	1	23	....	188	52	6	11,036	220	....	....	....	86	22	375
Ohio	1905	7	1	32	1	184	52	8	4,406	140	5	2	5	41	20	499
	1900	5	1	32	1	189	53	8	2,491	65	....	....	....	54	21	275
	1890	4	2	34	17	163	54	6	5,997	63	....	....	....	174	28	172
Pennsylvania	1905	30	3	112	4	400	120	48	13,268	311	46	60	21	124	131	1,191
	1900	25	2	106	8	414	113	21	13,328	470	25	5	[2] 45	208	152	1,198
	1890	12	3	86	36	305	98	17	8,223	164	....	....	....	133	161	707
All other states [5]	1905	11	6	91	10	595	103	7	19,681	424	4	125	....	110	83	1,110
	1900	7	5	101	3	530	90	8	9,005	204	2	37	....	123	40	837
	1890	11	14	74	8	341	102	10	11,025	98	....	....	....	374	81	607

[1] Not intended to cover tanks used in marketing the products, though possibly some such are included.
[2] Includes 1 refrigerating machine.
[3] Not reported separately.
[4] In 1890 included in "all other states."
[5] Includes establishments distributed as follows: 1905—Colorado, 2; Indiana, 1; Kansas, 1; Louisiana, 1; Maryland, 1; New York, 5; Texas, 7; West Virginia, 1; Wyoming, 1; 1900—Colorado, 2; Indiana, 1; Kansas, 1; Maryland, 1; Michigan, 1; New York, 4; Texas, 1; West Virginia, 1; 1890—California, 2; Colorado, 2; Maryland, 2; Massachusetts, 1; New York, 9; West Virginia, 4.

The total number of engines of all kinds in 1905 was greater than in 1900 by 237, or 26.6 per cent, and greater than in 1890 by 584, or 107.2 per cent. The gasoline engines in 1905 constituted 5 per cent of the total number of engines and in 1900, 3.1 per cent. The number of electric motors reported in 1905 was greater than in 1900 by 155, or 224.6 per cent, while the number of pumps and related machines was less by 153, or 78.8 per cent.

Table 7 shows the details of the industry, as to the kind, quantity, and value of products, and the average price per barrel for each census from 1880 to 1905.

TABLE 7.—PRODUCTS, BY KIND, QUANTITY, AND VALUE: 1880 TO 1905.

PRODUCT.	1905 Number of barrels.	1905 Value.	1905 Average value per barrel.	1900 Number of barrels.	1900 Value.	1900 Average value per barrel.	1890 Number of barrels.	1890 Value.[1]	1890 Average value per barrel.	1880 Number of barrels.	1880 Value.[1]	1880 Average value per barrel.
Burning oils	34,344,522	$100,571,825	$2.93	31,266,513	$82,244,961	$2.63	16,967,397	$47,842,537	$2.82	11,002,249	$36,839,613	$3.35
Residuum	3,187,921	3,138,361	0.98	596,615	688,455	1.15	1,194,967	1,235,490	1.03	229,133	297,529	1.30
Paraffin oils	1,644,400	6,210,279	3.78	1,606,783	3,987,037	2.48	684,849	3,022,048	4.41	79,465	408,023	5.13
Paraffin wax	794,068	10,007,274	12.60	774,924	7,791,149	10.05	241,951	2,904,902	12.01	[2] 20,856	631,944	30.30
Reduced oils	[3] 4,352,248	16,794,789	3.86	[3] 1,766,090	7,108,168	4.03	856,730	2,333,923	2.72	230,859	1,395,037	6.04
Naphtha and gasoline	5,811,289	21,314,837	3.67	5,615,554	15,991,742	2.85	3,290,462	7,115,388	2.16	1,502,181	2,961,561	1.97
Neutral filtered oils	504,042	1,942,153	3.85	608,185	2,256,626	3.71	....	....	....	....	....	....
All other products [4]	....	15,025,802	....	....	3,861,246	....	....	[5] 20,546,910	....	....	1,171,511	....

[1] The cost of packages was not uniformly included in the value of products for 1880 and 1890. This should be considered in connection with the average value per barrel.
[2] Reported as 7,889,626 pounds in 1880, but the figures were converted into barrels on the assumption that the average weight of paraffin in a 50-gallon barrel is 378.3 pounds.
[3] Includes filtered cylinder oils and greases.
[4] Includes coke, carbon points, and black naphtha.
[5] Includes $15,258,054, the value of packages made at the refinery.

The number of products which may be obtained from petroleum in the process of refining is very large, the number actually obtained commercially being so great as to render it impracticable to obtain returns in detail for all of them. Consequently a somewhat arbitrary, but well recognized, classification has been adopted. For instance, all of the various grades of illuminating oil and fuel oil are combined under the head of burning oils. The classification followed in Table 7 is that used in the Eleventh and Twelfth censuses. It differs somewhat from that used in the Tenth Census, this change being due to the manner in which the industry has developed. The returns for the earlier censuses have been grouped in this table in

as close conformity as possible with the returns for the later censuses. Where products have been reported which did not conform with this classification, they have been included in the item "all other products." No attempt has been made in collecting the statistics for the later censuses to extend the inquiry in detail to embrace vaseline or cosmoline, and other minor products, or candles and compounds or compositions of various kinds, but the values for these are included in "all other products."

The amount and per cent of increase in the total value of the products for 1905 over that for each of the previous censuses has been given in Table 1. The total value of products was greater than the cost of the crude petroleum from which they were produced by $67,518,229 in 1905; by $43,505,177 in 1900; by $40,121,415 in 1890; and by $27,364,637 in 1880.

In comparing values at different censuses it is to be borne in mind that a larger percentage of oil is now shipped in bulk than was formerly the case.

Table 8 shows for each item presented in Table 7, the amount and per cent of increase for the censuses from 1880 to 1905.

TABLE 8.—PRODUCTS, WITH AMOUNT AND PER CENT OF INCREASE IN QUANTITY AND VALUE: 1880 TO 1905.

PRODUCT.	INCREASE.						PER CENT OF INCREASE.					
	1900 to 1905		1890 to 1905		1880 to 1905		1900 to 1905		1890 to 1905		1880 to 1905	
	Quantity (barrels).	Value.	Quantity (barrels).	Value.	Quantity (barrels).	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Burning oils	3,078,009	$18,326,864	17,377,125	$52,729,288	23,342,273	$63,732,212	9.8	22.3	102.4	110.0	212.2	173.0
Residuum	2,591,306	2,449,906	1,992,954	1,902,871	2,958,788	2,840,832	434.3	355.9	166.8	154.0	1,291.3	954.8
Paraffin oils	37,617	2,223,242	959,551	3,188,231	1,564,935	5,802,256	2.3	55.8	140.1	105.5	1,969.3	1,422.0
Paraffin wax	19,144	2,216,125	552,117	7,102,372	[1] 773,212	9,375,330	2.5	28.4	228.2	244.5	[1] 3,707.4	1,483.6
Reduced oils	2,586,158	9,686,621	3,495,518	14,460,866	4,121,389	15,399,752	146.4	136.3	408.0	619.6	1,785.2	1,103.9
Naphtha and gasoline	195,735	5,323,095	2,520,827	14,199,449	4,309,108	18,353,276	3.5	33.3	76.6	199.6	286.9	619.7
Neutral filtered oils	[2] 104,143	[2] 314,473	....	....	....	....	[2] 17.1	[2] 13.9	....	....	....	....
All other products	....	11,164,556	....	[2] 5,521,108	....	13,854,291	....	289.1	....	[2] 26.9	....	1,182.6

[1] Reported as 7,889,626 pounds in 1880, but the figures were converted into barrels on the assumption that the average weight of paraffin in a 50-gallon barrel is 378.3 pounds.
[2] Decrease.

Table 9 shows the percentage which the quantity of each product formed of the total quantity of crude petroleum used, for the censuses from 1880 to 1905.

TABLE 9.—*Per cent distribution of crude petroleum among the several products: 1880 to 1905.*

	1905	1900	1890	1880
Burning oils	61.0	71.6	65.9	75.2
Residuum	5.7	1.4	4.6	1.6
Paraffin oils	2.9	3.7	2.7	0.5
Paraffin wax	1.4	1.8	0.9	0.1
Reduced oils	7.7	4.0	3.3	1.6
Naphtha and gasoline	10.3	12.9	12.8	10.3
Neutral filtered oils	0.9	1.4	....	....

Table 10 shows the percentage which the value of each product formed of the total value of all products, for the censuses from 1880 to 1905.

TABLE 10.—*Per cent distribution of the value of products: 1880 to 1905.*

	1905	1900	1890	1880
All products	100.0	100.0	100.0	100.0
Burning oils	57.5	66.4	56.3	84.3
Residuum	1.8	0.6	1.4	0.7
Paraffin oils	3.5	3.2	3.6	0.9
Paraffin wax	5.7	6.3	3.4	1.4
Reduced oils	9.6	5.7	2.7	3.2
Naphtha and gasoline	12.2	12.9	8.4	....
Neutral filtered oils	1.1	1.8	....	6.8
All other	8.6	3.1	24.2	2.7

The total volume of refined products for which quantities were reported was, in 1905, 50,638,490 barrels (of 50 United States gallons); in 1900, 42,234,664 barrels; in 1890, 23,236,356 barrels; and in 1880, 13,157,570 barrels. Using these figures, it appears that in 1905 1 pound of sulphuric acid was used in refining for every 5.9 gallons of products obtained; in 1890, 1 pound for every 6.1 gallons; and in 1880, 1 pound for every 7.2 gallons. It is evident that these proportions are to some degree affected by the variations in "all other products." Taking the single item "burning oils," it appears that in 1905, 1 pound of sulphuric acid was used for every 4.1 gallons of burning oils produced; in 1890, 1 pound for every 4.4 gallons; and in 1880, 1 pound for every 6 gallons.

At the outset of the preparation of this report it was planned to present separate statistics for illuminating oils and fuel oils, since in the public mind they represent, because of their uses, two different classes of products, and the inquiry was made with this in view. Careful consideration of the returns and of the development of the industry indicates that this separation can not be made with much precision, and even suggests that the illuminating oil shown separately at the census of 1880 included oil used as fuel.

The use of petroleum oils for fuel is old. In the report on the Production, Technology, and Uses of Petroleum and its Products for the Census of 1880 it is stated [1] that "Petroleum and nearly all its products and natural gas are used in glass houses for producing

[1] Page 251.

high temperatures and flames free from soot and other materials that would injure the glass;" also "The kerosene stoves are being brought to a great degree of perfection and are found to be very useful. * * * These stoves act best with high-test oil and are therefore safe. Their healthfulness depends upon the manner in which they are used. * * * Yet they are cheap and convenient, are used by tens of thousands, and their use is increasing." For fuel purposes a kerosene may be used which is less completely refined than that used for lamps, especially so when the oil is used under steam generators and the same fraction in a different condition of purity might be styled illuminating oil or fuel oil, from a consideration of the purposes to which it is to be put. In the progress of the art, the residuum came to be used as fuel. In the report on the Refining of Petroleum for the Census of 1890 it is stated:[1] "Of the residuum reported as fuel, 399,243 barrels were consumed in the refineries located in the state of New York." As described further on, certain petroleum residuums have for a long time been treated for the production of lubricating oils and paraffin products, though they may be "cracked" to produce burning oils. This latter method of treatment was described in 1872 by S. Dana Hayes.[2] Since the census of 1900 was taken, beginning with the opening of the Lucas well at Beaumont, Tex., a grade of petroleum has been made accessible, in large quantity, whose residuum finds use as a fuel oil; and the development of the California field, in which a somewhat related petroleum is found, has led to such an increase in its use that it has become an important factor. These petroleums give such different yields and yield certain products so different from those obtained from the crude petroleums employed before these fields were operated, that it is believed confusion has been introduced into the trade and into the returns in the designation of fuel oils and also of residuum. The confusion in the use of the term "fuel oil" is the greater because crude petroleum, especially that from the southeastern Texas and Louisiana field and from California, is also used extensively as fuel.

The petroleum distillates of various grades have also come into extended use as the source of energy in explosion engines. As early as 1872[3] the Brayton engine, which was the first in which kerosene was employed, was patented in the United States, and the use of these heavier distillates for engine fuel has materially increased from that time. Oil for this use may be reported as engine distillate, or even as gas oil.

[1] Page 363.
[2] On the history and manufacture of petroleum products. Am. Chemist, vol. 2, pages 401 to 405.
[3] Redwood, Petroleum, vol. 2, page 725.

In consideration of these conditions, the term "burning oils," introduced in the census classification of this industry in 1890, has been retained notwithstanding that, according to Hayes,[4] the term "burning oils" was originally applied to the kerosenes. According to the present Census use, this term embraces all petroleum distillates employed for the production of light, heat, or power, other than the "naphthas and gasolines," and it has this significance in the table.

Premising that, for the census of 1905 at least, these statistics are to an extent the result of estimates, it may be stated that at the census of 1905 there were produced 27,135,094 barrels of illuminating oils, having a value of $91,366,434, and 7,209,428 barrels of fuel oils, having a value of $9,205,391. At the census of 1900 there were produced 25,171,289 barrels of illuminating oils, having a value of $74,694,297, and 6,095,224 barrels of fuel oils, having a value of $7,550,664. The increase in the quantity of illuminating oils for 1905 over 1900 was 1,963,805 barrels, and the increase in value was $16,672,137. The increase in the quantity of fuel oils for 1905 over 1900 was 1,114,204 barrels, and the increase in value was $1,654,727.

The statistics obtained for residuum are, for reasons similar to those given above, regarded as open to question, it being doubtful if the same "fraction" is returned by different establishments under this category. There can be no question that with the use of the Texas and California petroleums in refining, a considerable part of the residuum is different from that obtained from the Pennsylvania and similar petroleums. Hence the statistics for the present census are not strictly comparable with those for previous censuses. The difficulties here set forth do not obtain with the statistics for the total products as they do for the separate ones.

The total volume of refined products for which quantities were reported in 1905 aggregated 50,638,490 barrels of 50 United States gallons. Of this quantity, 34,344,522 barrels were burning oils, and 5,811,289 barrels were naphtha and gasoline. These three classes of products constituted the principal products when rated by quantity, while burning oils and naphtha and gasoline were the principal products when rated by value.

The total quantity of crude petroleum produced in the United States in 1904, according to the reports to the United States Geological Survey, was 117,063,421 barrels (of 42 United States gallons), of which 2,647,060 barrels were exported. The quantity of crude oil reported as used by the refineries was 66,982,862 barrels, which leaves 47,433,500 barrels added to stocks

[4] Loc. cit.

of crude oil, or lost by leakage, fire, or other accident, or otherwise to be accounted for. The corresponding remainder obtained by a similar computation with the data of the census of 1900 was 2,257,846 barrels. The fact that this amount not definitely accounted for was larger at the census of 1905 may be to a degree attributed to the increased use in recent years of crude petroleum for fuel and for other purposes.

The total quantity of refined products reported separately on the census schedules for 1905 amounted to 50,638,490 barrels of 50 gallons each, which would be equivalent to 60,283,917 barrels of 42 gallons. Deducting this from the 66,982,862 barrels of crude petroleum reported as used by refineries there is a difference of 6,698,945 barrels of 42 gallons each, or 5,627,114 barrels of 50 gallons each. This difference represents to some degree the quantity of crude petroleum used in the manufacture of "all other products." In 1900 this quantity was represented by 1,731,644 barrels of 42 gallons. This volume is somewhat in excess of the true quantity used for "all other products," since all manufacturing processes are accompanied by some necessary waste and in the processes of refining by destructive distillation it is practically impossible to prevent the formation of gases and vapors which escape condensation.

Table 11 shows for 1880 and for each year between 1889 and 1904 the total production of crude petroleum, as taken from the reports of the United States Geological Survey, and the exports of crude and refined oils, as obtained from the reports of the Bureau of Statistics of the Department of Commerce and Labor, the latter being converted from the fiscal year to the calendar year.

TABLE 11.—PRODUCTION OF CRUDE PETROLEUM, AND EXPORTS OF CRUDE AND REFINED OILS, FROM 1889 TO 1904, AND FOR 1880.

YEAR ENDING DECEMBER 31—	Production (barrels of 42 gallons).	EXPORTS.[1]												
		Total.		Crude, including all natural oils, without regard to gravity.		Refined or manufactured.						Residuum, tar, pitch, and all other, from which the light bodies have been distilled.		Paraffin and paraffin wax (value).
						Naphthas, benzine, gasoline, etc.		Illuminating.		Lubricating and heavy paraffin oil.				
		Barrels of 50 gallons.	Value.	Barrels of 50 gallons.	Value.	Barrels of 50 gallons.	Value.	Barrels of 50 gallons.	Value.	Barrels of 50 gallons.	Value.	Barrels of 50 gallons.	Value.	
1904	117,063,421	20,442,325	$80,624,207	2,223,530	$6,350,682	499,788	$2,321,714	15,227,163	$58,384,273	1,793,762	$12,393,382	698,082	$1,174,156	$8,272,856
1903	100,461,337	18,733,945	72,628,539	2,530,234	6,782,150	259,463	1,518,541	13,836,744	51,355,668	1,912,439	12,690,051	195,065	282,129	9,596,308
1902	88,766,916	21,284,672	68,597,143	2,904,674	6,331,011	393,653	1,392,771	15,576,020	49,079,055	1,644,010	10,872,154	766,315	922,152	8,398,450
1901	69,389,194	21,581,490	72,784,912	2,540,160	6,037,544	433,695	1,741,547	16,549,589	53,490,713	1,506,119	10,260,125	551,927	1,254,983	7,959,991
1900	63,620,529	19,737,129	74,493,707	2,763,223	7,340,749	371,410	1,681,201	14,783,269	54,692,872	1,424,227	9,933,548	395,000	845,337	8,185,518
1899	57,070,850	19,020,488	64,982,249	2,353,679	5,957,829	358,080	1,557,607	14,491,259	48,466,200	1,386,584	8,344,735	430,886	655,878	7,650,449
1898	55,364,233	19,729,612	52,551,048	2,298,302	4,764,111	340,532	1,053,231	15,223,042	38,542,082	1,279,367	7,385,054	588,369	806,570	6,362,871
1897	60,475,516	19,885,954	59,057,547	2,429,774	5,020,968	268,606	994,781	15,918,390	46,229,579	1,024,566	6,478,479	244,618	333,740	5,283,929
1896	60,960,361	17,809,179	62,383,403	2,218,472	6,121,836	246,986	1,059,542	14,329,111	48,630,920	1,010,511	6,556,775	4,009	14,330	4,563,168
1895	52,892,276	17,690,041	46,660,082	2,225,705	5,161,710	296,024	910,988	14,297,183	34,706,844	868,379	5,867,477	2,750	13,063	4,504,912
1894	49,344,516	18,165,045	41,499,806	2,438,527	4,415,915	311,115	943,970	14,607,372	30,676,217	803,811	5,449,000	4,220	14,704	3,276,837
1893	48,412,666	16,084,424	42,142,058	2,234,070	4,567,391	346,080	1,074,710	12,844,796	31,719,404	648,657	4,738,892	10,821	41,661	4,552,543
1892	50,509,136	14,892,770	42,729,157	2,087,942	4,696,191	327,866	1,037,558	11,788,364	31,826,545	680,537	5,130,643	8,061	38,220	4,159,538
1891	54,291,980	13,478,111	46,174,835	1,934,456	5,365,579	228,500	868,137	10,628,902	34,879,759	666,205	4,999,978	20,048	61,382	3,978,884
1890	45,822,672	13,876,597	52,270,953	1,931,453	6,535,499	249,253	1,050,613	11,017,468	39,826,086	641,811	4,766,850	36,612	91,905	2,920,262
1889	35,163,513	13,614,108	53,293,299	1,703,793	6,134,002	279,688	1,208,116	11,035,393	41,215,192	558,065	4,638,724	37,169	97,265	2,287,760
1880	26,286,123	6,935,588	34,505,645	734,962	2,772,400	302,302	1,344,529	5,722,631	29,047,908	112,140	1,141,825	63,553	198,983	(2)

[1] Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.

[2] Not reported separately.

Table 11 shows that in 1904, 18,218,795 barrels of refined products, or 36.6 per cent of the total for that year, were exported. In 1899, 16,666,809 barrels, or 39.5 per cent of the refined product for the year, were exported. The total value at the ports of shipment of the refined petroleum exported in 1904 was $74,273,525. Although the quantity was greater in 1901 and 1902, this is the largest value ever reported for refined petroleum exported, and it exceeds the value of that exported in 1899 by $15,249,105, or 25.8 per cent; of that exported in 1889 by $27,114,228, or 57.5 per cent; and of that exported in 1880 by $42,540,280, or 134.1

per cent. Taking the quantity of the crude petroleum produced as shown for the census years in Table 11, and the quantity used in refineries as reported in Table 5, the proportion of the total crude petroleum refined at the census of 1905 was 57.2 per cent; in 1900, 81.8 per cent; in 1890, 66.9 per cent; and in 1880, 66.3 per cent.

Notwithstanding the extent of the exports of petroleum and petroleum products from the United States, mineral oils and paraffin to a limited extent are imported. It is probable that these are special articles, and that the paraffin is largely from other sources than petroleum. This importation is shown by quantity and value in Table 12.

TABLE 12.—*Imports of mineral oils and paraffin:*[1] *1901 to 1905.*

YEAR.	MINERAL OILS.		PARAFFIN.	
	Gallons.	Value.	Gallons.	Value.
1905	10,000,502	$494,221	1,425,074	$73,435
1904	4,653,508	280,746	1,224,392	65,040
1903	3,708,127	227,217	2,654,716	149,479
1902	3,235,467	193,076	[2] 754,265	44,332
1901	2,147,938	172,465	[2] 255,603	17,551

[1] "Commerce and Navigation of the United States," Bureau of Statistics, Department of Commerce and Labor. Each of these articles is dutiable if imported from countries which impose duty on like articles imported from the United States; otherwise, free. Part of these imports in each year paid duty.

[2] Includes only the quantity on which no duty was paid. The value was reported and is included in the aggregate value for the year.

Table 13 presents by states the detailed statistics of petroleum refining for 1905.

TABLE 13.—PETROLEUM REFINING—DETAILED SUMMARY, BY STATES: 1905.

	United States.	California.	Ohio.	Pennsylvania.	All other states.[1]
Number of establishments	98	19	12	43	24
Capital:					
Total	$136,280,541	$5,453,012	$10,384,741	$32,846,578	$87,596,210
Land	$10,221,401	$520,017	$694,604	$1,583,414	$7,423,366
Buildings	$9,389,369	$459,915	$742,333	$2,464,759	$5,722,362
Machinery, tools, and implements	$53,223,807	$1,900,860	$3,214,746	$11,664,990	$36,443,211
Cash and sundries	$63,445,964	$2,572,220	$5,733,058	$17,133,415	$38,007,271
Proprietors and firm members	24	....	....	22	2
Salaried officials, clerks, etc.:					
Total number	1,974	162	216	408	1,188
Total salaries	$2,724,065	$211,752	$266,171	$556,501	$1,689,641
Officers of corporations—					
Number	152	16	20	50	66
Salaries	$612,428	$48,475	$60,480	$138,565	$364,908
General superintendents, managers, clerks, etc.—					
Total number	1,822	146	196	358	1,122
Total salaries	$2,111,637	$163,277	$205,691	$417,936	$1,324,733
Men—					
Number	1,692	130	185	322	1,055
Salaries	$2,041,076	$154,346	$200,591	$396,532	$1,289,607
Women—					
Number	130	16	11	36	67
Salaries	$70,561	$8,931	$5,100	$21,404	$35,126
Wage-earners, including pieceworkers and total wages:					
Greatest number employed at any one time during the year	19,621	867	2,181	4,922	11,651
Least number employed at any one time during the year	13,713	582	1,694	3,411	8,026
Average number	16,770	678	1,900	4,227	9,965
Wages	$9,989,367	$477,118	$1,053,598	$2,371,027	$6,087,624
Men 16 years and over—					
Average number	16,256	678	1,717	4,112	9,749
Wages	$9,832,124	$477,118	$999,040	$2,342,811	$6,013,155
Women 16 years and over—					
Average number	82	....	54	2	26
Wages	$26,117	....	$18,602	$557	$6,958
Children under 16 years—					
Average number	432	....	129	113	190
Wages	$131,126	....	$35,956	$27,659	$67,511
Average number of wage-earners, including pieceworkers, employed during each month:					
Men 16 years and over—					
January	16,158	573	1,869	4,331	9,385
February	16,247	617	1,849	4,253	9,528
March	16,798	630	1,801	4,309	10,058
April	16,431	689	1,594	4,355	9,793
May	16,668	695	1,636	4,383	9,954
June	17,117	778	1,734	4,228	10,377
July	16,921	816	1,830	4,011	10,264
August	16,635	743	1,658	3,962	10,272
September	16,278	687	1,659	4,092	9,840
October	15,883	649	1,676	4,031	9,527
November	15,339	602	1,686	3,791	9,260
December	14,597	657	1,612	3,598	8,730
Women 16 years and over—					
January	88	....	59	2	27
February	83	....	55	2	26
March	85	....	51	2	32
April	82	....	49	2	31
May	67	....	45	2	20
June	70	....	45	2	23
July	64	....	38	2	24
August	65	....	36	2	27
September	73	....	49	2	22
October	102	....	74	2	26
November	103	....	74	2	27
December	102	....	73	2	27
Children under 16 years—					
January	425	....	135	114	176
February	427	....	134	116	177
March	407	....	133	108	166
April	424	....	134	120	170
May	443	....	125	157	161
June	433	....	109	134	190
July	405	....	124	57	224
August	466	....	127	93	246
September	499	....	129	141	229
October	496	....	134	127	235
November	403	....	133	109	161
December	368	....	131	80	157

[1] Includes establishments distributed as follows: Colorado, 2; Indiana, 1; Kansas, 1; Louisiana, 1; Maryland, 1; New Jersey, 4; New York, 5; Texas, 7; West Virginia, 1; Wyoming, 1.

TABLE 13.—PETROLEUM REFINING—DETAILED SUMMARY, BY STATES: 1905—Continued.

	United States.	California.	Ohio.	Pennsylvania.	All other states.
Miscellaneous expenses:					
Total	$5,297,508	$146,719	$752,712	$1,218,572	$3,179,505
Rent of works	$40,568	$2,525	$5,393	$3,731	$28,919
Taxes, not including internal revenue	$572,663	$15,225	$79,030	$49,979	$428,429
Rent of offices, interest, insurance, and all other sundry expenses not hitherto included	$4,635,029	$128,919	$667,504	$1,159,400	$2,679,206
Contract work	$49,248	$50	$785	$5,462	$42,951
Materials used:					
Total cost	$139,387,213	$4,130,809	$7,662,397	$38,921,919	$88,672,088
Crude petroleum—					
Barrels of 42 gallons	66,982,862	4,369,600	4,195,871	17,977,686	40,439,705
Cost	$107,487,091	$3,431,754	$5,143,137	$31,957,135	$66,955,065
Sulphuric acid—					
Short tons	162,152	13,103	10,787	45,177	93,085
Cost	$2,003,031	$316,831	$120,594	$489,741	$1,075,865
Caustic soda—					
Pounds	11,161,376	469,929	1,005,404	2,680,308	7,005,735
Cost	$208,440	$10,018	$17,380	$54,987	$126,055
Sulphur—					
Short tons	888	843	43	....	2
Cost	$13,380	$11,437	$1,871	....	$72
Pyrites—					
Long tons	20,661	....	2,833	3,780	14,048
Cost	$79,784	....	$14,247	$18,910	$46,627
Coopers' and carpenters' materials, cost	$5,628,274	$6,542	$362,970	$569,458	$4,689,304
Tinners' materials, cost	$6,361,764	$10	$140,817	$1,001,930	$5,219,007
Barrels, cases, and tin cans (purchased), cost	$5,880,310	$124,852	$432,872	$1,613,024	$3,709,562
Fuel	$5,136,266	$191,386	$497,738	$1,543,851	$2,903,291
Rent of power and heat	$3,668	$1,377	....	....	$2,291
Mill supplies	$403,886	$2,368	$21,814	$133,991	$245,713
All other materials	$5,666,501	$21,977	$908,792	$1,187,618	$3,548,114
Freight	$514,818	$12,257	$165	$351,274	$151,122
Products consumed:					
Sulphuric acid, short tons	49,379	1,988	5,665	8,398	33,328
Products:					
Total value	$175,005,320	$5,748,598	$10,948,864	$47,459,502	$110,848,356
Burning oils—					
Barrels of 50 gallons	34,344,522	1,379,149	1,961,105	9,977,418	21,026,850
Value	$100,571,825	$2,641,916	$5,188,808	$28,412,940	$64,328,161
Residuum—					
Barrels of 50 gallons	3,187,921	2,152,437	111,339	152,282	771,863
Value	$3,138,361	$1,667,414	$210,911	$408,634	$851,402
Paraffin oils—					
Barrels of 50 gallons	1,644,400	20,666	114,201	371,724	1,137,809
Value	$6,210,279	$120,077	$411,121	$1,173,727	$4,505,354
Reduced oils—					
Barrels of 50 gallons	2,783,148	17,504	150,169	626,449	1,989,026
Value	$6,068,360	$57,602	$586,258	$1,684,169	$3,740,331
Neutral filtered oils—					
Barrels of 50 gallons	504,042	114	300	253,874	249,754
Value	$1,942,153	$290	$2,900	$754,370	$1,184,593
Filtered cylinder oils—					
Barrels of 50 gallons	1,366,661	15,734	71,446	618,390	661,091
Value	$9,332,299	$43,791	$540,617	$3,565,552	$5,182,339
Grease (lubricating, etc.)—					
Barrels of 50 gallons	202,439	23,875	19,659	88,085	70,820
Value	$1,394,130	$79,594	$158,885	$377,137	$778,514
Naphtha and gasoline—					
Barrels of 50 gallons	5,811,289	238,015	467,594	1,774,626	3,331,054
Value	$21,314,837	$926,063	$1,676,529	$6,402,492	$12,309,753
Paraffin wax—					
Barrels of 50 gallons	794,068	3,898	47,533	279,511	463,126
Value	$10,007,274	$38,919	$549,515	$3,017,004	$6,401,836
Sludge acid—					
Short tons	165,104	18,045	....	38,216	108,843
Value	$400,480	$25,829	....	$140,627	$234,024
Coke and black naphtha, value	$149,653	$10,008	$30,448	$23,481	$85,716
All other products, value	$14,475,669	$137,095	$1,592,872	$1,499,369	$11,246,333
Equipment:					
Stills—					
Heated by steam, number	282	14	32	112	124
Heated by superheated steam, number	15	....	1	4	10
Heated by fire, number	1,610	92	184	400	934
Agitators, number	374	47	52	120	155
Chilling houses for paraffin, number	67	1	8	48	10
Hydraulic or other presses, number	311	2	41	124	144
Storage tanks—					
Crude petroleum, number	304	43	20	131	110
Capacity in gallons	245,760,493	12,439,724	8,964,030	42,683,656	181,673,083
Refined petroleum, number	3,575	375	499	1,191	1,510
Capacity in gallons	576,458,825	49,410,383	84,888,635	110,111,758	332,047,749
Cooper shops	64	11	7	30	16
Tin shops	17	2	1	3	11
Power:					
Number of establishments reporting	94	17	12	42	23
Total horsepower	49,337	1,323	4,406	13,268	30,340
Owned—					
Engines—					
Steam—					
Number	1,072	25	140	311	596
Horsepower	43,480	1,048	4,172	9,689	28,571
Gas or gasoline—					
Number	57	1	5	46	5
Horsepower	2,059	10	139	1,740	170
Electric motors—					
Number	224	6	2	60	156
Horsepower	3,318	40	20	1,659	1,599
Other power, horsepower	330	75	75	180	....
Rented—					
Electric motors—					
Number	14	14	....	....	....
Horsepower	150	150	....	....	....

HISTORICAL AND DESCRIPTIVE.

Petroleum, known also by other names, such as rock oil, mineral oil, coal oil, or earth oil, is an oily liquid, varying in color from light straw through amber, red, and brown to black. Existing in the earth, it is obtained from either springs or wells. Petroleum is distributed widely, and its existence was known to the ancients. The aborigines were familiar with many localities in North America where it issued from the ground and spread out on the surface of the water in contiguous pools, creeks, and rivers. The oil spring of the Seneca Indians, located near what is now Cuba, N. Y., was one of the more celebrated of these springs, and the oil collected there was used for medicinal purposes.

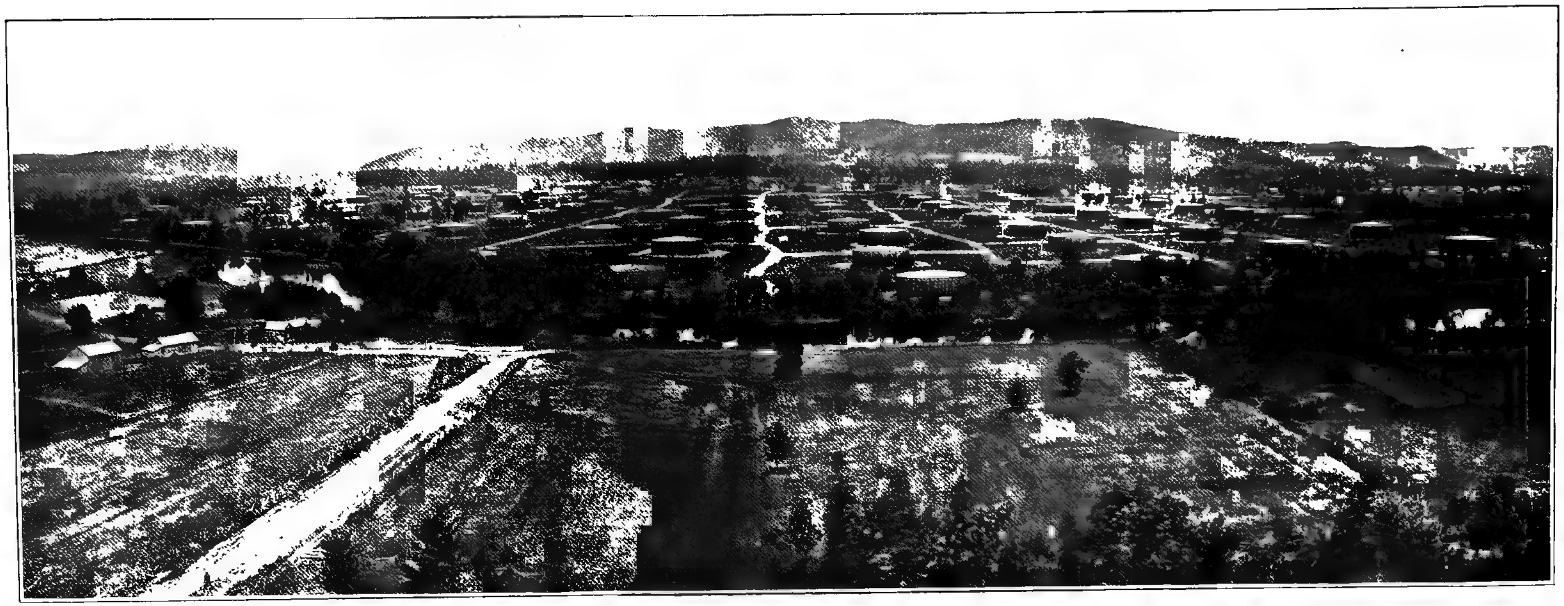
Although a natural product, petroleum is not a definite chemical compound. It consists of a mixture of various hydrocarbons from several different acyclic and cyclic series, and of hydrocarbon derivatives containing sulphur, or oxygen, or nitrogen, or other elements. These chemical substances have widely varying physical properties and appearances, differing in color, odor, volatility, viscosity, inflammability, specific gravity, boiling and freezing points, and in other particulars; hence mixtures of them in different proportions will appear quite unlike. Furthermore, the components in such mixtures are held together so loosely that they may be separated, more or less completely, by comparatively simple methods, such as filtration, and especially capillary filtration, through fuller's earth, kaolin, boneblack, or other finely divided and porous solids, or by fractional distillation. Therefore, considering the conditions which affect the natural material in different localities, it is not surprising that the varieties of petroleum obtained in Texas, California, and Ohio should differ in appearance and properties from each other and from the better known Pennsylvania petroleum; or that in Kansas petroleum may be obtained which is immediately suitable for use as an illuminant, while in West Virginia petroleum is found which is suitable for use as a lubricant without undergoing any preliminary treatment.

If the survey were extended to include the petroleum found in foreign countries, such as Canada, Russia, Burma, and elsewhere, additional variations might be noted, yet Mabery, who has exhaustively examined a large number of samples from widely different sources, says:[1] "Now, after these years of arduous labor, I have reached the conclusion that petroleum from whatever source is one and the same substance, capable of a simple definition—a mixture in variable proportions of a few series of hydrocarbons, the product of any particular field differing from that of any other field only in the proportion of these series and the members of the series." However, from a commercial standpoint, petroleum from different localities is regarded as different substances, and the products are referred to and considered from the standpoint of some predominating or characteristic constituent. Thus, Pennsylvania petroleum is classed as an oil with a paraffin base; Texas and California petroleum, as oils with an "asphalt" base; petroleum from the Lima field in Ohio, as a sulphur oil; and so on as the characteristics are developed.

Although petroleum as found in nature, and therefore styled crude petroleum, has in recent years come to be used extensively in locomotives and ships, and for metallurgical, manufacturing, and domestic purposes as a fuel, and although other uses have been found for it, such as oiling roads, coating piles, and exterminating insects, yet for the majority of purposes petroleum must be treated before use to adapt it to the special purpose to which it is to be applied, and this treatment constitutes the industry known as petroleum refining. The processes employed in petroleum refining are many in number and different in degree of complexity. The particular process used in any given case is determined by the character of the petroleum to be treated and the character of the products sought. In the case of the more complex processes a method of treatment suitable for a crude petroleum from one locality is poorly adapted or wholly unsuitable for the treatment of crude petroleum from another. The processes of refining may be roughly classified as follows: Treatment by settling to remove suspended matter and water; filtration; fractional distillation; destructive distillation; and, subsequent to or combined with the process of distillation, the treatment of the distillates, known as fractions, with acids or alkalies, or both, and sometimes with other chemicals; also, treatment by chilling, pressure, and filtration.

The cleaning of crude petroleum by settling is the process used in the case of heavy, viscid oils found in loose sand of great fineness, since the sand and water become mixed with the oil and are pumped up with it. An example of this method is found in the practice obtaining in the Kern River oil field of California, where great difficulty is experienced from sand. It is customary there to pump the oil into small excavations made in sandy soil as close to the well as possible. These holes, called "sumps," are originally of from 500 to 2,000 barrels capacity, but they rapidly become shallower from the deposits of detritus from the oil. From the sumps the oil flows by gravity to storage reservoirs, which are shallow excavations made in the soil and covered with light wooden roofs. These reservoirs are often of great size, and it is customary to carry in them as large a quantity of oil as possible, in order that the sand may settle and the water separate completely. During the summer months the oil is continually at a

[1] Journal American Chemical Society, 1906, vol. 28, page 417.



STORAGE TANKS FOR PETROLEUM.

high temperature and becomes clean by this simple treatment. During cooler weather, or whenever the reservoir purification is thought insufficient, the oil, before shipment, is passed through a small steel tank provided with steam coils, where it is heated for a sufficient time to remove these impurities. The degree of temperature, which is from 110° to 150° Fahrenheit, and the duration of time, which is usually only a few hours, are determined by the specific gravity of the oil and the amount of impurities it contains. According to Prutzman,[1] "The high degree of purity which is obtained by the use of these simple methods is quite astonishing. Even where the impurities originally amount to 50 per cent of the bulk of the crude oil, which is often the case, the oil finally shipped will not contain more than 2 per cent of foreign matter of all kinds, and the larger part of the fuel oil in the San Francisco market, at least, will be found to contain less than 1½ per cent of impurity." This treatment results in other advantages, for the gas with which the oil is charged as it comes from the well, and which affects its gravity and flash point, is also very largely removed. It is interesting to note that when oils, such as these heavy crude oils, are exposed in shallow pools to sunlight in hot climates the oil is so oxidized that its gravity is lowered while its viscosity is raised, and the oxidation may proceed so far as to convert the oil into a tarry mass. If the dissolved gases be removed from the oils and sunlight be excluded, the effects of high natural temperatures are not serious, and it thus becomes possible to store oil for considerable periods in such reservoirs. Although the oil has been distinctly improved by methods of purification, such as described, the product is not considered as refined oil in the Census classification and the establishment in which the operation is carried on is not included with refineries.

Filtration was resorted to for the purification and refining of petroleum, especially in preparing it for use in medicine, at a very early date. Doctor Hildreth in 1833 mentions[2] filtering petroleum through charcoal, by which process much of its "empyreumatic smell is destroyed and the oil greatly improved in quality and appearance." Since then a large number of different substances have been employed as filtering mediums to remove from crude petroleum all sediment and suspended matter, together with part of the color and odor. Since the development of refining by distillation, filtration for the removal of color and odor has been confined largely to the denser natural oils which are used for the production of lubricating oils and which may lose some of the qualities that especially fit them for this purpose, if subjected to the conditions which obtain in the process of distillation. Crude oils which contain lubricating oils, but owing to the presence of volatile portions are too fluid for direct use, are reduced to the desired consistency by partial evaporation, either by exposing them in shallow tanks to solar heat, or by driving off the more volatile portions in stills, or both, and they may be further cleansed and purified before or after concentration by filtration.

Partial distillation is employed in the production of reduced oils. This process requires the use of shallow wooden tanks on the bottom of which flat steam coils are placed; water is run into the tanks to a depth of from 8 to 10 inches, and a layer of oil 1 inch in depth is placed upon the water; the whole is then heated until the oil becomes very limpid, and this temperature is maintained until the desired specific gravity is reached. An advantage in this treatment, as in the method of settling described above, lies in the removal of every kind of dirt, especially the minute particles of grit which may have been held in suspension in the viscid oil, and if allowed to remain would seriously detract from the value of the reduced oil as a lubricant. Another method practiced in the manufacture of reduced oils consists in suspending sheets of loosely woven cloth vertically above troughs in a heated chamber, and through a perforated pipe spraying the crude oil upon the upper edge of these curtains. As the oil slowly descends the curtain it spreads out as a thin film, thus exposing a very large surface to the heated atmosphere of the chamber; and thereby the more volatile portions of the oil are rapidly driven off. At the same time the fiber acts as a filtering medium, retaining the sediment and other impurities of the crude oil, so that the surplus oil, as it drips from the lower border of the curtains into receiving troughs, is not only reduced and rendered more viscid but is also purified and cleansed.

The process of refining by fractional distillation depends primarily upon the fact that different liquids, when subjected to the same pressure, boil at different temperatures, from which it might be inferred that if a mixture of different liquids were heated gradually, each component of the mixture as it reached the temperature at which it boils would assume the state of a vapor and separate from the mixture. If only these simple conditions obtained, the separation of a liquid mixture into its individual components could be effected merely by heating the liquid to the successive boiling points of its components, and condensing and collecting the distillates. But the conditions are not so simple, for the separation of components of solutions by heat depends not only on their relative boiling points, but also on their relative vapor pressures, and vapor pressures change with the temperature. Further, the most complicated conditions arise where, as in the case of crude petroleum, the mixture consists of liquids which dissolve one another, that is, are miscible in each other, and the complexity increases with the increase in the number of components.

[1] Bulletin No. 32, California States Mining Bureau, page 56.
[2] American Journal of Science, vol. 24, series 1, page 63.

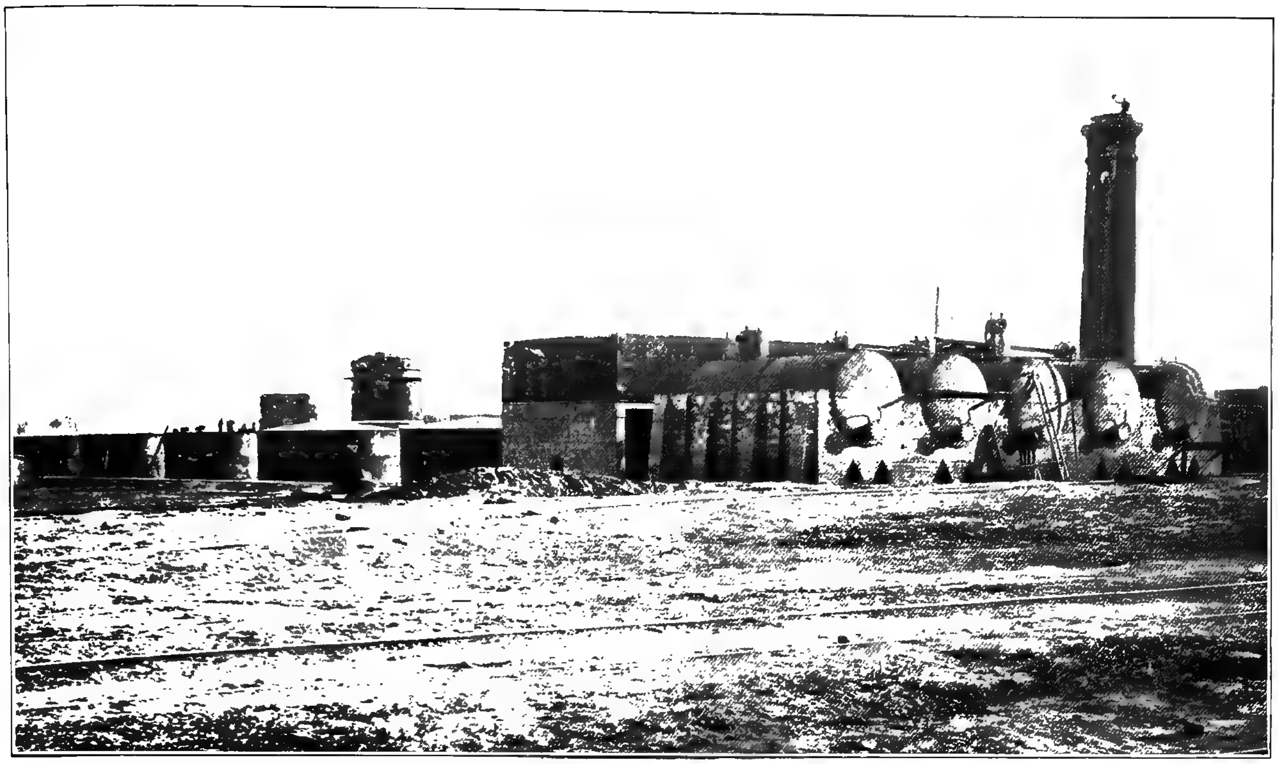
The case may be stated for a system of two miscible liquids as follows: Such a mixture on being heated is continually changed in composition during vaporization, and this brings about a change in the pressure and the composition of the vapor. If the two components have very different vapor pressures and their boiling points are correspondingly wide apart, the vapor pressure and boiling point of the mixture usually fall between those of the components, and under these circumstances the more volatile liquid goes over in the largest proportion in the first stages of the distillation, while the greater portion of the less volatile liquid remains behind. The separation is not, however, complete. The liquid mixture has been divided into portions, called fractions, but each fraction still contains some of each constituent. It has obeyed the law stated by Barker:[1] "Since at the same temperature the vapor pressure of a liquid is proportioned to its volatility, a mixture of two or more vapors when condensed will yield a liquid richer in the more volatile constituent." By repeating the distillation of the separate fractions and uniting those obtained between the same boiling point limits, a practically complete separation may eventually be effected. But if, on the other hand, the two components of the liquid taken as an example have vapor pressures and boiling points which lie near together, one of two other consequences may follow. The mixture behaves similarly to one composed of liquids not completely miscible, and the vapor pressure of the solution is greater than that of each of its components. In this case there must be a certain ratio between the two pure liquids at which the common vapor pressure will attain its highest value. This mixture will consequently have the lowest boiling point of any possible combination of these two substances, and it will, on distillation, behave like a pure substance with a constant boiling point and distill over, leaving in the still the substance which is in excess with respect to this boiling point mixture. On the other hand, the mixture of the two liquids may have a lower vapor pressure than that of either component. Such liquids must form, in definite proportions, that mixture which has the lowest vapor pressure and the highest boiling point of any possible mixture of these two substances, and on distilling the liquid, anything present, for example an excess of one of the components which is more volatile than this definite mixture, passes over first, leaving in the still the mixture with the highest boiling point, which behaves much like a single substance, and distills without separating into its components.

The distillation of crude petroleum is usually carried out in either cylindrical or "cheese box" stills. The size and the arrangement of these stills and the method of heating them vary with the character of oil to be treated and the products sought. The cylindrical still consists of a cylinder of boiler plate, 30 to 40 feet in length and 12 feet 6 inches to 14 feet in diameter, the lower half of which is usually of steel. The still is set horizontally in a furnace of brickwork, which is usually so constructed that the upper surface of the still is exposed to the air. Stills are often set in batteries of from two to ten for convenience in operation. The "cheese box" still has a body and a dome-shaped top made of boiler plate, and a double curved bottom made of steel plate. They may be 30 feet in diameter and 9 feet in height, and they are set vertically on a series of brick arches. The working charge of the cylindrical still is from 600 to 1,000 barrels, and of the cheese box still, 1,200 barrels.

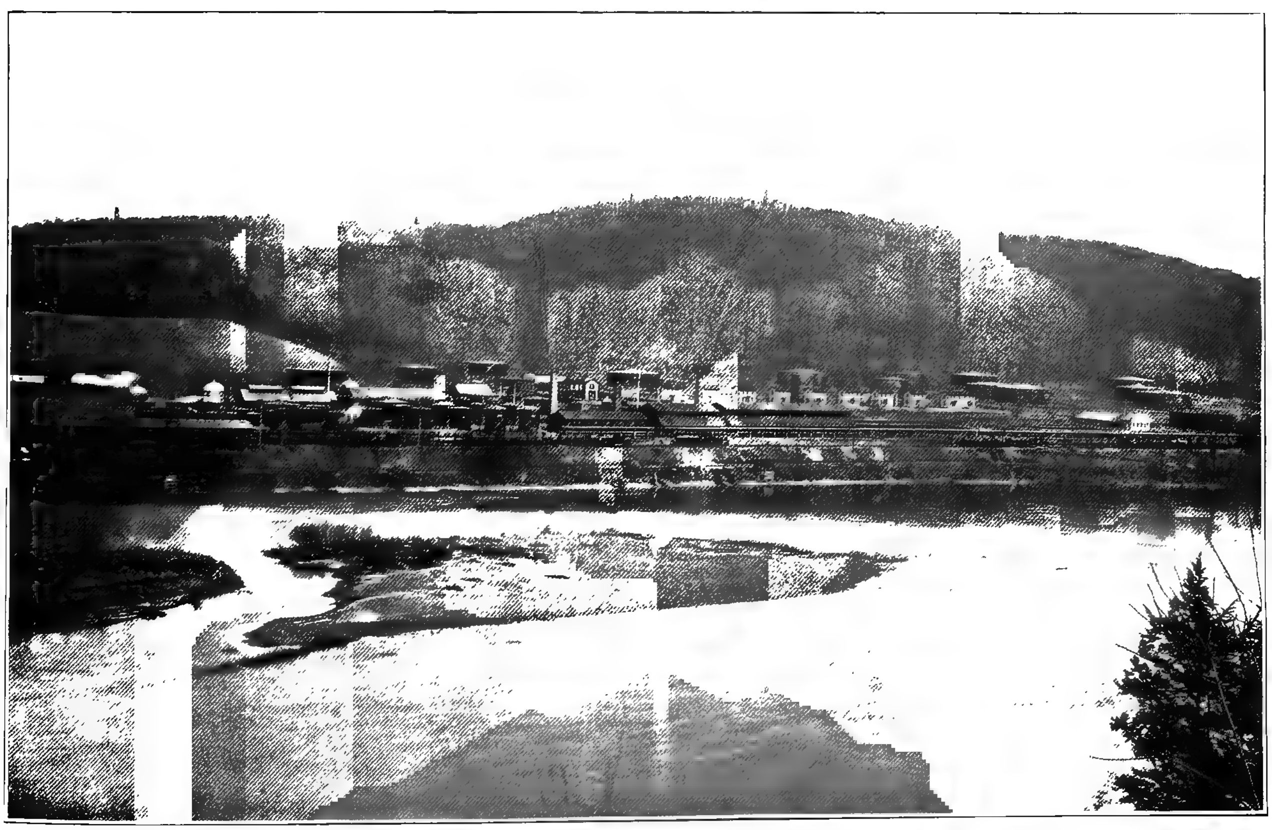
Either form of still may be heated by direct fires or by coils of steam pipes, either closed or perforated, which may be fitted into the stills to heat the oil, or by the injection of steam to facilitate, on the principle of partial pressures, the passing over of the distillates. Some stills are connected with an exhaust pump by which a vacuum may be maintained in them during distillation. The top of the still is usually provided with a dome into which the vapors rise and from which they pass to the condensers. The condensing apparatus consists primarily of long coils of pipe immersed in tanks through which cooling water flows. All the coils or lines are made to converge near the terminal so that they enter the receiving house within a few inches of each other. A trap is placed in the pipe near the end of each line for the purpose of leading off the gases or difficultly condensable vapors which are produced, and these are either collected for fuel or discharged into the atmosphere. The condensing pipes generally deliver the distillates into box-like receptacles, sometimes known as "sight boxes" because they have sides of plate glass through which the running of the distillate may be observed. Hydrometers, by which the density of the distillate may be noted, and thermometers, for determining its temperature, are immersed in the flowing liquid or in samples of the run which may be taken from time to time for testing. As the character of the distillate changes, the delivery pipes from the condensers are turned to different receptacles. The receptacles lead to storage tanks or reservoirs, sometimes styled "cut tanks."

In addition to the above stills there are in use what are known as tar stills, which are made of iron or steel and are cylinders 10 feet in diameter and 20 feet in length. They are set horizontally in brickwork in batteries of two and are heated by fire. They hold about 260 barrels, and are provided above with air condensers leading from a dome in the center of the top of each cylinder. The condensers are of 4-inch iron pipe coiled in three turns one above the other in a rectangle of about the length and width of the still. As the coil makes one complete turn, it is trapped to

[1] George F. Barker: Physics, 1892, page 318.



STILLS FOR CRUDE PETROLEUM.



BIRD'S-EYE VIEW OF ECLIPSE WORKS.

carry off the products which have condensed at that stage.

As stated, the process of distillation varies with the circumstances, but the operation may take place as follows: The oil is first allowed to stand in large tanks so that part of the water and sediment are removed before it is pumped to stills into which live steam is introduced. Distillation commences at once and the distillate is collected in a receptacle continuously until its specific gravity reaches 0.74 (60° B.). The condensers are now connected to another receptacle, and as the temperature rises and distillation proceeds the distillate is collected until its specific gravity reaches 0.81 (40° B.). The heavy oil which remains is often distilled with superheated steam for the production of lubricating oil. The first original distillate is redistilled by steam and separated, commonly, into five different fractions. The second original fraction may be subjected to a second distillation to drive off lighter oils, which are then added to the first original fraction. The third original fraction may be chilled so as to cause the paraffin present to crystallize. The semisolid mass of paraffin thus produced is then subjected to pressure to drive out the oil which is present. This oil is further subjected to the action of steam in a still to remove from it certain oils which possess a pungent and offensive odor. The distillates are then subjected to chemical treatment or to filtration, or to both if further refining be desired.

It was noted long ago in the making of coal gas that if the less volatile products from the distillation of the coal were allowed to condense and fall back into the hot retort, the liquid was decomposed into other substances, some of which were much more volatile than the original condensation product. This process of breaking up an organic liquid by heat is called "cracking." It is a process of destructive distillation and may be applied to many substances. It has long been applied to the treatment of petroleum, for by its use a larger portion of illuminants and oils of low boiling point may be obtained from a crude petroleum than is usually obtained by simple distillation only, since in the latter case a large per cent of the petroleum may remain as heavy oils or paraffins. In this process the operation of distillation is carried out as before, using fire, but when the second original fraction has been separated and collected, the fires are slackened and the distillation allowed to proceed slowly, in consequence of which the vapors of the heavy oil are repeatedly condensed upon the dome of the still and fall back upon the hot oil beneath, with the result that there is produced a large volume of gas, composed chiefly of marsh gas and hydrogen; a distillate of suitable specific gravity for the production of illuminating oil; and a heavy, tarry residue, called "residuum," which remains in the still. This residuum goes to the tar still, where, on further distillation by fire, there is collected at the first trap heavy distillate, at the second trap intermediate distillate, and at the third trap light distillate, while tar coke is left in the still. The first of the above distillates is wax bearing, and in the last part of its run this distillate is known as wax tailings; the third consists largely of illuminants, while the second distillate is of an intermediate character. All are joined to analogous materials passing through the refinery and are reworked by methods similar to those described above.

Oils that are to be subjected to chemical treatment to improve their color, or to remove components which might interfere with their use for particular purposes, are pumped from the cut tanks into the agitators. The latter are narrow upright cylinders with conical bottoms, generally lined with sheet lead and provided with an air blast descending from above and with outlets below for the spent chemicals and the treated oils. Agitators may hold 50,000 gallons of oil at one charge. The reagents usually employed are concentrated sulphuric acid and caustic soda or other alkalies. The sulphuric acid forms sulphonic acids, and addition and other compounds with the unsaturated hydrocarbons, through which they become soluble in water, and may be removed. At the same time other of the components of the oil are oxidized, so that, as a result of the reaction, when the oil is mixed with acid by means of the air blast, the mixture becomes thick and black and there is an evolution of sulphur dioxide. The mass is allowed to stand and thereby separates into layers of oil and spent or "sludge" acid. The latter is drawn off and the oil washed by agitation with water. It is then treated with an alkaline solution, by means of which not only any free sulphuric acid but also any acid salts or other bodies present may be neutralized. After the alkaline solution has settled and been drawn off, the oil is washed until all traces of alkali are eliminated, and then it is drawn off to settling or sunning tanks. In special cases it may now be again distilled to fraction it more completely, or it may be treated in a steam still to reduce it.

The quantity of sulphuric acid required in refining petroleum and the length of exposure to its action depends on the original purity of the distillate and the purity sought. Cracked oils require more acid than uncracked, and the Ohio oils require more than the Pennsylvania. Usually the amount of acid required increases with the density of the distillate. It is, as a rule, added in repeated doses until the desired result is obtained. The acid sludge is sometimes treated so as to regain the sulphuric acid for reuse; at other times it is used in the manufacture of fertilizers and for other purposes in chemical manufacture.

In 1905, 165,104 short tons of sludge acid, having a value of $400,480, or $2.43 per ton, were reported as having been sold from the refineries. The weight of sludge acid thus accounted for formed 78.1 per cent of

the total sulphuric acid used in refining in that year. In 1890 there were reported 33,911 tons of sludge acid used for fertilizers and chemicals, and 19,962 tons for recovered sulphuric acid, the total, 53,873 tons, constituting 56.1 per cent of the total sulphuric acid reported as used in refining petroleum at that census. In 1880 there were reported 22,163 tons of sludge acid used for fertilizers, and 21,159 tons for recovered sulphuric acid, the total, 43,322 tons, constituting 94.5 per cent of the total sulphuric acid reported as used in refining petroleum at that census. The alkali sludge has sometimes been heated to destroy the organic matter present and recover the alkali, but this is usually found unprofitable.

When sulphur is present in petroleum, it is difficult of removal, so that special treatment must be given oils, such as Lima oil, which are high in sulphur contents. Some refiners effect this by distilling the petroleum over scrap iron and treating the distillate first with an alkaline solution of lead oxide, and then with flowers of sulphur to remove the last traces of lead. Much the greater part, however, is distilled over copper oxide, the oxide being regained by burning off the sulphur.

According to Mabery,[1] "Probably 50 tons of sulphur daily is a conservative estimate of the amount extracted from Ohio oil and burned off into the atmosphere. It is claimed for this process that it is capable of removing the sulphur to two one-hundredths of 1 per cent, which is probably correct." In addition to the chemicals mentioned, others are sometimes used, among which are chromic acid or bichromate of potash and sulphuric acid, employed to oxidize the acrid and objectionable components; nitronaphthalene, added to the oil prepared for sale to mask the phenomenon of fluorescence, or to debloom the oil; and many others mentioned in the patents on petroleum refining.

The classification of petroleum products is a matter of difficulty because the same name has at various times been given to different substances, some of which are not products of petroleum, and because the same material has been known by different names. The different products may, to some degree, be differentiated by their boiling points, specific gravities, and fire tests. Yet again there is confusion from the use, for liquids lighter than water, of the Baumé hydrometer, which has a purely arbitrary scale, with which to gauge the densities of the oils, instead of one which would measure their real specific gravities directly, so that a 60° oil on the Baumé scale is one whose real specific gravity is 0.745, while a 48° B. oil is one whose real specific gravity is 0.794; in other words, the higher the number on the Baumé scale, the lower is the real specific gravity and the lighter the oil. Likewise, the fire test, or test of the behavior of the oil on exposure to a naked flame or source of ignition, covers both the flashing point test, for determining the lowest temperature at which the oil gives off vapors which form combustible and explosive mixtures with air, and the burning point test, for determining the lowest temperature at which the body of oil will take fire and continue to burn. It is greatly to be regretted that this confusion exists in the literature on the subject, and particularly in the statute books, as the flashing point test is the one by which the community is protected from accidental explosions and fires in the handling and use of illuminating oils.

With this introductory explanation, it may be stated that the term "naphtha and gasoline" embraces pentane, boiling point 100.4° F., real specific gravity 0.625, which is used as a standard of light in photometric work; petroleum ether, boiling point 104° F. to 158° F., specific gravity 0.65 to 0.66 or 85° to 80° B., which is sometimes known as Sherwood oil, and is used as a solvent for caoutchouc and fatty oils, and for carburetting air in gas machines; 76° gasoline, boiling point 158° F. to 194° F., specific gravity 0.66 to 0.69 or 80° to 75° B., known also as 680 spirit, motor spirit, petrol, carburine, and boulevard gas fluid, and used in naphtha lamps and internal combustion engines, in the extraction of oil from seeds and fat from garbage and wool, and in carburetting water gas; naphtha, boiling point 177° F. to 230° F., specific gravity 0.69 to 0.70 or 76° to 70° B., known also as Danforth's oil, ordinary spirit (when in the condition of untreated distillate), deodorized spirit (when purified), and city naphtha, and used as petrol in motor cars, for burning in vapor stoves and street lamps, as a solvent for resins in making varnishes, and in the manufacture of oilcloths; stove naphtha, specific gravity 0.70 or 70.4° B.; ligroïn, boiling point 176° F. to 248° F., specific gravity 0.71 to 0.73 or 67° to 62° B., used as a solvent in the chemical laboratory and in pharmacy and for burning in sponge lamps; benzine (deodorized), boiling point 248° F. to 302° F., specific gravity 0.73 to 0.75 or 65° to 57° B., used as a substitute for turpentine for cleaning printers' type, and for dyers', scourers', and painters' uses. In the refinery all of the above mentioned fractions may be included in the substances known as A-naphtha, specific gravity 0.74 or 64° to 60° B.; B-naphtha, specific gravity 0.72 or 68° to 64° B.; and C-naphtha, specific gravity 0.70 or 80° to 68° B. All petroleum distillates having a specific gravity above 60° B. may be styled "naphtha and gasoline." Although engine distillates which are a cut between "naphtha and gasoline" and kerosene, may be classed with the former, the lightest engine distillates, which run well up in the sixties in gravity, are prepared for small engines, while the heaviest are intended to replace kerosene in kerosene engines. As a rule they are

[1] Journal of the American Chemical Society, 1906, vol. 28, page 432.

not as carefully purified as gasolines and kerosenes of the same gravity and differ, in the lower members, from kerosene in that no attention is paid to the flashing point.

The distillate collected between 60° B. and 40° B., or specific gravity 0.744 to 0.829, is crude illuminating oil. The refined illuminating oils are known by a large number of names, the most common general name being kerosene. The oils are graded by their color, their flashing point tests, their burning point tests, and their specific gravities. Water white oil of 120° F. flashing point test, 150° F. burning point test, and 48° B. gravity is standard, but there are many other gravities of water white oil. The Quartermaster's Department of the Army has specified 135° F. flashing point as the minimum for oil supplied to that department. Other grades, by color, are prime white, having a faint yellow color, and standard white, having a pronounced yellow color. Water white oil of gravity 45.5° B. and 175° F. burning point is frequently sold as headlight oil for use in locomotives. Water white oil of 36° to 38° B., and 300° F. burning point is known as mineral sperm oil, mineral seal oil, mineral colza oil, coach oil, and 300° oil, and is used as an illuminant in railway coaches and lighthouses, and for other purposes where readily ignitible oils are objectionable. Such an oil produced from wax oil, when pressed, and not lighter than 34° B., is used in Pennsylvania in compounding miners' lamp oil. An oil having a specific gravity of from 0.85 to 0.86 and a flashing point above 100° F. is known as gas oil. Stove oil is generally a cut from the crude still following the kerosene.

The lubricating oils vary so greatly as to be beyond description within reasonable limits. All should have high burning points, and a natural lubricating oil to be of real value must not ignite under a temperature of 325° F. The lightest of the lubricating oils, varying in gravity from 32° to 38° B., are known as neutral oils, or when further purified by filtration through boneblack or fuller's earth, as they usually are, as neutral filtered oils. Heavier lubricating oils are styled "spindle oil" and "cylinder oil." The most important characteristics which distinguish these oils are high burning point, and viscosity, and low cold test. Cylinder oils are obtained by distilling the heavy oils, from which the naphthas and illuminating oils have been removed, with superheated steam, taking care that no cracking takes place. Or they may be produced by distillation in a vacuum. Paraffin lubricating oils are obtained by chilling the first distillate from the tar stills or other wax bearing distillates, these being chilled in the chilling house by cold brine from an ammonia ice machine. The chilled mass is pressed to separate it into paraffin and oil, and this oil is then redistilled and cut into several fractions. The common cuts for paraffin oil are one of 29° to 30° B., and a heavy cut of 23° to 26° B. To give the oils higher burning points and viscosities, they are cut from one-half to one degree higher than wanted and then reduced in a reducing still by means of steam and fuel.

Besides the various oils, semisolid products, represented by vaseline, and solids, such as paraffin and petroleum coke, are obtained in petroleum refining. Vaseline is obtained by filtering heavy cylinder stock through boneblack filters until the required color is obtained; the first runnings from the filters, which are sufficiently light in color, may be used for vaseline, and the darker part used as filtered cylinder stock. To secure the necessary consistency and melting point, pure paraffin is melted and added to the filtered material. Rod wax obtained from the tubes and rods of pumping wells and the salvy residues from oil tanks and pipe lines, which is known in the industry as B. S., are employed in the manufacture of these semisolid petroleum products. They are used directly as ointments or employed with drugs in the manufacture of ointments and salves, and are styled in the United States Pharmacopœia *Petrolatum molle*, or soft petrolatum, the requirement being that they have a melting point of from 104° to 113° F. If the rod wax be pressed, it yields a solid with a low melting point and a salvy half-paraffin nature, which, either directly or when mixed with chicle or balata gum, is used as chewing gum. Paraffin, obtained from the chilling and pressing of the wax bearing distillates, preferably distilled at high temperatures to insure crystallization, is generally manufactured in three varieties, with melting points of 125° F., 128° F., and 135° F., known as C., B., and A. paraffin, respectively. The *Petrolatum spissum*, or hard petrolatum, of the United States Pharmacopœia, should have a melting point of from 113° to 125° F. Thus petroleum paraffin stands next in the order of petroleum products as classified by the melting points. The paraffin is purified by chemical treatment like that for the other distillates, by filtration to remove color, by recrystallization from solution in benzine, and by sweating. This last is done by chilling it in cakes in shallow trays having wire-mesh bottoms. These are stacked in rooms, which are gradually heated. The paraffin, having the lowest melting point, becomes liquid, drips out, and is collected; with another increase in temperature and change of receivers the paraffin of the next higher melting point is obtained, and the operation is thus continued until the desired degree of separation is effected.

Paraffin is used for many purposes in the arts. The harder varieties are used largely in the manufacture of candles, about 5 per cent of stearic acid being added to prevent the candle from softening and bending. They are used also for finishing calicoes and woven goods and in laundry work to produce a luster. The softer varieties are used for coating jellies and fruits in preserving jars, for the preparation of translucent and waterproof paper, for waterproofing cloth, for mixing with stearic

acid and wax in candle making, for impregnating the wood of Swedish matches, and as the absorbent in the process of enfleurage or extraction of the perfume from flowers.

Residual pitches are obtained in the distillation of the "asphaltic" petroleum of California, the "semiasphaltic" petroleum of Texas, and of some paraffin petroleum. The residues from California petroleum have been used to a considerable extent in the paving industry and are generally known as "D" grade asphalt or by some special trade designation or brand. According to Richardson[1] this "D" grade asphalt, when properly made, contains not over 10 per cent of fixed carbon, while the asphalt from Texas oil contains a higher percentage of this constituent. The more liquid portions of these residuums are used in compounding sheet asphalt, in which they constitute from 12 to 50 per cent of the composition. For this purpose, California oil should be from 10° to 13° B.; Texas oil, 14° to 16° B.; and Eastern oil, 18° to 22° B.; and all should have a flashing point above 350° F. to be suitable for use.

Other petroleum products used in the paving industry are Pittsburg flux, produced by heating a gallon of ordinary Pennsylvania petroleum residuum with about 1 pound of sulphur; Ventura flux, made by treatment of the California residuum in a similar manner; byerlyte, formed by oxidizing Pennsylvania residuum by sucking air through it, Byerly of Cleveland having found that oxygen, like sulphur, effected a condensation of the residuum; and hydroline B., produced by blowing air through the "asphaltic" residuum from Texas petroleum. These substances are prepared for use as fluxes for native asphalt. By blowing the crude oil with air similar oxidation and inspissation takes place. If the oil be warmed at the start, the oxidation not only maintains the temperature but causes it to rise to as high as 900° F. Water vapor is evolved, though but little, if any, of the more volatile components of the oil are driven off. The blown residues thus formed are used for waterproofing, for paints, for rubber substitutes, and for use in the arts. Residuums are used in oiling dirt roads. Petroleum coke, which is the porous, brilliant black solid left in the tar stills, is used in the manufacture of electric light carbons.

Greases are semisolid to solid products used in lubrication. They are usually made by mixing a lime soap with a petroleum distillate. A rosin-lime soap and mineral oil produces axle grease or set grease, and a mixture of lime soap made from horse fat or cottonseed oil with mineral oil is styled "engine grease." Both may be mixed with lead oxide, mica, soapstone, or graphite. Wax tailings are used on the rolls in iron and tin-plate mills under the name of roll grease. Compounded oils are produced by mixing mineral oils with animal oils, such as neat's-foot, lard, tallow, sperm, and whale, or vegetable oils, such as rape-seed, olive, or palm, with soaps, such as lead and aluminum soap, and with solids, such as graphite, mica, and soapstone. A very common oil, known as mineral castor oil, is made by compounding an aluminum soap with petroleum distillate. The number of mixtures possible is well-nigh infinite, and a very large number of these have been made, offered in commerce, and used.

From the description here given of the petroleum products and from the consideration of the brief discussion of the laws which govern the behavior of miscible liquids when subjected to distillation, as previously set forth, it is apparent that the petroleum distillates offered in commerce are not definite chemical compounds, or even definitely compounded and constant mixtures. Although, by the use of the hydrometer and thermometer, fractions may be obtained having within limits similar specific gravities and boiling points, yet it does not follow that two distillates possessing these characteristics are otherwise similar, and observation of such distillates from different localities shows them to be different. It follows then that the general trade names only roughly designate the different distillates, and that a desired distillate must be carefully described in specifications by its physical and chemical properties. It is evident too that the process of refining requires much distilling and redistilling, with compounding of the distillates between redistillations, to obtain the maximum quantity of a desired product from the crude petroleum, and that these processes will vary in kind and number with the particular crude petroleum treated and as to whether or not cracking is resorted to. When there is added to these the employment of fire, or low-pressure steam, or high-pressure steam, or a vacuum in the processes of distillation and the variations in chemical treatment and filtration, it is apparent that no general description of the process of petroleum refining can set forth the operations of the different individual factories except in a very broad way.

The transportation and storage of petroleum products, and more especially of the lighter distillates, are of great public concern, since they have frequently given rise to accidents, owing to the fact that they freely give off, at the lowest natural temperatures, volatile inflammable vapors which form explosive mixtures with air. The liquid distillates are transported on a large commercial scale, in bulk, in pipe lines, tank cars, and tank ships, to distributing points, from which they are delivered in tank wagons, barrels, and cans to small consumers. Probably the larger part of all the lighter distillates produced are distributed in tank cars, which consist of cylindrical steel tanks mounted on their sides on platform cars. They vary in size, but are frequently 25 feet long by 6 feet in diameter and carry about 8,000 gallons of distillate. They are provided on the upper side with a covered

[1] The Modern Asphalt Pavement, 1905, page 253.


REFINERY, WHITING, INDIANA.


REFINERY, WHITING, INDIANA.

manhole, through which they are filled, and a safety valve to diminish the liability to explosion in case of fire. For shipment abroad, oil is put in rectangular tin cans holding 5 gallons each, and two such cans are packed in a wooden case. As examples of the hazard attending the transportation of petroleum products, there may be cited the explosion at Rochester, N. Y., December 21, 1887, following leakage from a pipe line across that city, and the fire and explosion at the Sheraden Yard, Pittsburg, Pa., May 12, 1902, following the collision of other cars with a tank car in making up a train. The liquid distillates are generally stored in steel tanks above ground. These should be provided with safety valves or screened ventilators and should be surrounded by screen walls of such construction and height, or should be partly sunk in an excavation or pit, in such manner that the inclosure will hold all of the liquid contained in the tank and prevent its escape in case of fire. These tanks above ground are frequently struck by lightning. A safer method of storage is in underground tanks, and only such tanks should be permitted in the midst of populated districts. Yet in these cases special precautions should be taken in construction and maintenance to prevent corrosion and leakage, as the escape of these volatile inflammable liquids into sewers, wells, and cellars may lead to very serious disasters.

45254—MFG 1905—PT 4—08——39

APPENDIX A.

BIBLIOGRAPHY.

ALLEN, ALFRED H., and LEFFMANN, HENRY. *Petroleum and Shale Products; Commercial Organic Analysis*, Vol. II, Part II, pages 90–151. Philadelphia, 1900.

ARLINGTON MILLS, The. *Tops, a New American Industry*. Lawrence, Mass., 1898.

CHANDLER, C. F., Ph. D. *Report on Petroleum as an Illuminator*. New York, 1871.

COMMITTEE REPORT ON TANK CARS. *Proceedings Master Car Builders' Association*, 1903, page 312.

CREW, BENJAMIN J. *A Practical Treatise on Petroleum*. Philadelphia, 1887.

GOLDINGHAM, A. H. *Oil engines*. New York, 1900.

HAYDEN, H. F. *The Use of Petroleum as Furnace Fuel*. Washington, 1884.

HISCOX, GARDNER D. *Gas, Gasoline, and Oil Vapor Engines*. New York, 1898.

INTERNATIONAL LIBRARY OF TECHNOLOGY. *Petroleum and Products*. Scranton, Pa., 1902.

LUCAS, ANTHONY F. *The great oil well near Beaumont, Tex.* Trans. Am. Inst. Mining Eng. 1902, vol. 31, pages 362 to 374.

MABERY, CHARLES F. *Composition of American Petroleum*. Journal American Chemical Society, 1906, vol. 28, page 415.

NORTH, SYDNEY H. *Oil fuel. Its Supply, Composition, and Application*. Philadelphia, Pa., 1905.

OSTWALD, W., translated by J. Walker. *Outlines of General Chemistry*. London, 1890.

PECKHAM, S. F. *Nitrogen Content of California. Petroleum*. Am. J. Sec. [3]. 250–255: 1894.

PECKHAM, S. F. *The Genesis of Bitumens as related to Chemical Geology*. Proc. Am. Phil. Soc. 37, 108–139: 1898.

Petroleum. The Encyclopedia Britannica, 1885, vol. 18, page 712.

Petroleum. Universal Cyclopedia and Atlas, vol. 9, page 240. New York, 1903.

Report on the Production, Technology, and Uses of Petroleum and Its Products. Government Printing Office, Washington, 1884. (It contains a bibliography of 496 titles.)

Petroleum. The Encyclopedia Britannica Supplement, 1891, vol. 4, page 186.

PHILLIPS, WILLIAM BATTLE, Ph. D. *Texas Petroleum*, The University of Texas Mineral Survey Bulletin, No. 1, 1900.

PRUTZMAN, PAUL W. *Production and Use of Petroleum in California*, Bulletin No. 32, California State Mining Bureau. Sacramento, Cal., 1904.

REDWOOD, BOVERTON. *A Treatise on Petroleum*, two volumes. London, 1896.

Report of the Commissioner of Corporations on the Transportation of Petroleum. Government Printing Office, Washington, 1906.

Report of United States Naval Liquid Fuel Board. Government Printing Office, Washington, 1904.

RICHARDSON, CLIFFORD. *The Modern Asphalt Pavement*. New York, 1905.

SADTLER, SAMUEL P. *A Handbook of Industrial Organic Chemistry*. Philadelphia, 1895.

SCHWEITZER, P., Ph. D. *A Lecture on Petroleum*. Columbia, Mo., 1879. (It contains a bibliography of 169 titles.)

S. S. Atlas. New Oil-Tank Steamer for the Standard Oil Company, Marine Engineering, 1899, vol. 3, page 27.

Tar and Oil for Road Improvement, Circular No. 47, Office of Public Roads, United States Department of Agriculture. Government Printing Office, Washington, 1906.

THOMSON, CAPT. J. H., and REDWOOD, BOVERTON. *Handbook on Petroleum*. London, 1901.

WRIGLEY, HENRY E. *Special Report on the Petroleum of Pennsylvania*. Harrisburg, Pa., 1875.

APPENDIX B.

DIGEST[1] OF PATENTS RELATING TO PETROLEUM REFINING.

This digest covers the patents included in the subclasses named in Class 196, Mineral Oils, of the United States Patent Office classification.

Some of the patents in these categories are quite foreign to the subject under consideration and many but indirectly related to it. On account of the form which discussions of patent issues often take, it has been thought better, however, to include these latter patents. The aim in making the digest has been to give such a sketch as will indicate the nature of the invention and what is claimed by the inventor, this generally being done by an actual abstract from or paraphrase of the words of the letters patent; but no responsibility is assumed for the opinions, theories, or claims thus set forth. Other related patents may have been granted which do not appear in this digest, because they are not embraced in the subclasses enumerated. It is suggested that such patents may be found in the classes relating to illuminating gas, wood distillation, coke, and similar topics.

CLASS 196.—MINERAL OILS.

SUBCLASS 1.—APPARATUS.

113,023—March 28, 1871. BENJAMIN CRAWFORD. *Improvement in apparatus for purifying coal oil.*

Claims the treatment of explosive burning fluids to a hot water bath, by means substantially as described.

114,293—May 2, 1871. SAMUEL A. HILL AND CHARLES F. THUMM. *Improvement in distilling hydrocarbon oils.*

This invention consists in preventing the explosion of stills used for distilling hydrocarbon oils where hot oil is transferred from one still to another in the process of distilling it, by placing in the still which is to receive the hot hydrocarbon oil a small quantity of cold oil, which is heated to the evolving point prior to its receiving the hot oil, or by placing a quantity of oil in the still to which is to be transferred the hot oil and arranging the pipes which convey the oil from one still to the other so that the hot oil will enter the still at a point which is below the surface of the cold oil, or by charging the still which is to receive the hot oil with carbonic acid gas or its equivalent prior to charging it with the hot oil, the whole being for the purpose of expelling the air from the still prior to transferring hot oil into it.

156,600—August 21, 1874. JULIUS SCHUBERT. *Improvement in stills for refining oils.*

The invention relates to modes of eliminating impurities from natural oils with hot water, and consists in the use of a hot water coil in its purifier.

240,923—May 3, 1881. GEORGE H. PERKINS. *Apparatus for cooling and drying the air blast employed in the process of cooling and refining oil.*

Heretofore the process of agitating oil for purifying purposes has consisted, essentially, of the following steps, viz, warm distillate or oil from the still is mixed with cold water in an agitator. The mixed mass is agitated by means of a blast of air forced through it. The water is then drawn off from the bottom of the agitator and the cooled oil is dried or freed from moisture, as well as from tar, by the addition of sulphuric acid and by agitation together therewith, by means of a blast of air forced into and through the mixture in the agitator. By the above treatment the water and tar have been caused to separate from the oil and to fall to the bottom of the agitator, at which point they are drawn off. In the above operation, however, the temperature of the oil is gradually raised by reason of the increase of temperature of the air blast, due to the force and velocity with which it is forced into the agitator and by reason of the action of the sulphuric acid upon the water or moisture in said air blast, with the result that the separation of tar from the oil is rendered more slow and incomplete as the temperature of said mass increases.

This invention consists in providing an apparatus for cooling and drying the air blast employed in connection with oil agitators: and the inventor claims—

An apparatus for cooling and purifying oil, which consists in a vessel or agitator for containing oil, an air blower, an air blast pipe extending from said blower into a bath of sulphuric acid contained in an air-tight tank, an air blast pipe extending from the top of said acid tank to a point within said agitator in proximity to the bottom thereof, and a water jacket surrounding said last-named blast pipe and adapted to contain cold water.

240,937—May 3, 1881. WILLIAM G. WARDEN. *Apparatus for cooling and drying the air blast employed in the process of cooling and refining oil.*

Claims an apparatus for cooling and purifying oil, which consists in a vessel or agitator for containing oil, an air blower, an air blast pipe extending from said blower to a point within said agitator in proximity to the bottom thereof, and a water jacket surrounding said blast pipe and adapted to contain cold water.

305,182—September 16, 1884. HALVOR HALVORSON. *Apparatus for distributing crude petroleum.*

Claims an apparatus for dividing crude petroleum, comprising a plate or part having an upper inclined separating surface and a lower inclined collecting surface, which surfaces are continuous, means for delivering the oil to be separated to the upper part of the separating surface, and means for collecting the primary and secondary oils separately as they drip off, all arranged to operate.

306,837—October 21, 1884. JOHN S. KLEIN. *Device for heating oil.*

This invention has relation to improvements in devices for heating petroleum, and it consists in the novel arrangement of the same, whereby the oil is carried from the tank to a heating drum, where it is heated and again returned to the tank.

339,201—April 6, 1886. JOSEF MERZ. *Apparatus for making extracts.*

This invention relates to improvements in apparatus for extracting from substances their fatty and other constituents, such as oils, sulphur, coloring matter, and in general all such constituents as are soluble in volatile solvents, such as some of the hydrocarbons, bisulphide of carbon, alcohol, or ether, and it consists in a reservoir, an extraction chamber, a siphon regulator, a boiler, and a condenser.

481,392—August 23, 1892. JACOB P. ENGLE. *Separation of waste products of petroleum distillation.*

Claims the process of separating the heavy oil arising from petroleum distillation from the water with which it is mixed, consisting, essentially, in imparting to the material a rubbing action to break up the globules and separate the water from the oil.

680,639—August 13, 1901. GEORGE FITZHUGH CARTER. *Oil purifier.*

Claims an oil purifier comprising a storage tank, a heating drum including a cylindrical body portion and a central vertical stack, a coil in the body portion, a pipe leading from the lower end of the tank to the lower end of the coil, a pipe leading from the upper end of the coil through the stack and connected to the upper end of the tank, a burner in the body below the coil, and a pipe connected with the pipe passed through the stack at a point above the stack and leading downwardly and vertically to the burner.

SUBCLASS 2.—REDUCING GRAVITY.

42,121—March 29, 1864. ALLAN GREIG AND JAMES SMITH. *Improvement in apparatus for separating gas from petroleum.*

Petroleum, on being taken from the wells, contains a large quantity of gas, which, when separated from the oil, can be used for fuel and also for the purpose of illumination; and furthermore, by expelling the gas the inflammability of the oil and the danger of explosions consequent upon this inflammability are considerably reduced.

By the apparatus which forms the subject of this invention the gas is expelled from the oil by the action of a current of air forced in by a fan blower or any other convenient means, and by the action of an air pump it is stored up in a suitable receiver, from which it may be conducted through suitable pipes to the place or places of consumption.

46,794—March 14, 1865. JOEL GREEN. *Improved apparatus for deodorizing petroleum, benzole, etc.*

This invention consists in the employment of an apparatus for deodorizing or removing the gas contained in the oil in vacuo, in such a manner that the oil is properly agitated to free it of the gas and is properly drawn off by a pump, and at the same time wasteful expenditure from conversion of the oil into gas by too high a temperature is prevented by retaining said gas in the apparatus till the excess is again condensed.

[1] Copies of these patents may be obtained on application to the United States Commissioner of Patents, Washington, D. C., at a cost of 5 cents each.

52,477—February 6, 1866. NORMAN W. WHEELER. *Improved method of relieving liquids of gases.*

The essence of this invention consists in so combining a liquid trap with the discharge pipe of a force pump or a vessel containing liquid and gas that that part of the gas or air not in intimate combination with the liquid will be set free automatically.

54,917—May 22, 1866. JOHN JOHNSON. *Improvement in collecting the light oils from oil wells.*

Claims the separating and gathering at the wells a new article of commerce, viz, the light condensable vapors which rise with petroleum, and which may be pumped off under any suitable seal and condensed, and,
Volatilizing and condensing the condensable products from petroleum at the wells by forcing air or gases through petroleum as carriers of the light products.

71,619—December 3, 1867. FLEURY HUOT. *Improved mode of treating petroleum to remove the more volatile portions.*

Claims subjecting petroleum and other oils to the action of air while such oil is in a finely comminuted or atomic condition, as and for the purposes set forth.

81,654—September 1, 1868. ROBERT G. LOFTUS. *Improved process of treating petroleum to remove the more volatile portions.*

Claims the separation of the petroleum into fine streams, and causing the same to pass through the atmosphere, so as to enable the latter to vaporize and dissipate the inflammable elements thereof.

82,083—September 15, 1868. CALVIN CARPENTER, JR. *Improved lubricating material.*

This invention relates to a lubricating material which is produced by putting crude petroleum in an open tank or cistern, setting fire to it, and allowing it to burn until all the light constituents of the petroleum are consumed and a residuum is obtained of superior lubricating properties.
The separation of the light constituents of the crude petroleum from its heavy parts being facilitated by floating the crude oil on water and passing a current of air or stream through it from below.

89,998—May 11, 1869. ALBERT H. HOOK. *Improved apparatus for freeing petroleum and other liquids from gas.*

Consists of a vertical cylinder containing a series of wire gauge diaphragms upon which the petroleum falls, while by means of a fan air is sucked up through the falling oil.

140,801—July 15, 1873. SAMUEL VAN SYCKEL. *Improvement in refining petroleum.*

In pumping oil wells it has been found that a gas exists in the oil as it comes from the well, which becomes free as soon as the oil is exposed to the atmosphere, and passing off is, on account of its highly explosive character, a source of great danger, but which, if collected and conveyed to the fire of the pumping engine, may be utilized as fuel, with a consequent saving in that item of expenditure and also with a total avoidance of the danger which ordinarily results from the escape of this gas into the atmosphere. It is also well known that in the distillation of crude petroleum a portion of the lighter vapors give, when distilled, a product of comparatively small commercial value, which, according to its specific gravity, is variously known as naphtha, gasoline, benzine, etc. These products, if they could be separated from the oil at the wells, could be in many cases used as fuel with great advantage. It is sought by this invention to draw off such gases and lighter vapors from the oil at any suitable point between the well and the tank and conduct them to the engine furnace or to any other desired fire, where, being used as fuel, they will be usefully employed, with a consequent saving of expense.

147,783—February 24, 1874. GEORGE W. MYERS. *Improvement in apparatus for purifying oils.*

This invention has for its object removing the dangerous and explosive gases from refined petroleum oil by forcing a strong current of heated air through the said oil when spread into a thin sheet or spray, thereby increasing its illuminating qualities while rendering it safe. The invention consists of the combination of the fan nozzle, apron, screen or screens, inlet pipes, and outlet pipes with each other and with the tank, and in the combination of the air tank and the coil of steam pipe with the fan nozzle, apron, screen, or screens, inlet pipes and outlet pipes of the tank.

150,614—May 5, 1874. JACOB REESE. *Improvement in treating refined petroleum oils.*

Claims subjecting the distilled and refined illuminating petroleum oils of commerce to the action of a vacuum, or partial vacuum, when not subjected to the action of artificial heat, and,
Recharging or resaturating the oil, after being subjected to the action of a vacuum, or partial vacuum, with any suitable nonexplosive gas or vapor.

169,189—October 26, 1875. WILLIAM C. PARKER. *Improvement in apparatus for reducing crude oil.*

This invention relates to means for making lubricating oil for machinery and other purposes, and the invention consists in an apparatus of novel construction whereby crude oil can be economically reduced without a process of distillation.

175,014—March 21, 1876. WILLIAM H. BIRGE. *Improvement in apparatus for increasing the density of oils, etc.*

This invention relates to means for increasing the specific gravity or density of crude hydrocarbons, by the evaporation of a portion of the lighter constituents of the fluid in its passage from a reservoir to a tank or other receptacle.

182,625—September 26, 1876. GEORGE ALLEN. *Improvement in apparatus for treating petroleum.*

This invention relates to apparatus in which the oil is drawn from elevated troughs by capillary attraction, and conducted by means of muslin or other fibrous sheets to a pan or oil receptacle below, the oil in its passage to the said pan being subjected to the action of currents of heated air caused by suitable heating apparatus located in or near to the pan.

211,055—December 17, 1878. DAVENPORT ROGERS. *Improvement in apparatus for separating refined petroleum into oils of different grades and fire tests.*

Claims a steam heater or drum, its contained coil of oil supply pipe, separator cylinder, a spiral perforated flange and condenser all combined as shown and described, and constituting an apparatus for separating refined petroleum or distillates into oils of different specific gravities and fire tests, as specified.

SUBCLASS 3.—STILLS.

4,008—April 22, 1845. WM. T. CLOUGH. *Manufacture of a useful oil.*

Claims the process of distilling rosin or the residues from rosin gas works and the separation of the oily distillate from the acid distillate which is produced.

15,642—September 2, 1856. CUMMINGS CHERRY. *Improvement in apparatus for purifying oil obtained from mineral coal.*

Claims the arrangement of horizontal retorts, as combined with copper heads of the rectifying chamber steam conduits to the oil boiler and agitating apparatus.

27,768—April 10, 1860. LUTHER ATWOOD. *Improvement in apparatus for distillation of coal oils.*

Claims a volatile oil still capable of being heated at the sides, and constructed with a removable lower section consisting of the bottom and a short section of the sides.

29,218—July 17, 1860. BENJAMIN GARVEY. *Improvement in distillation of coal oil.*

This invention consists in using compressed air to support combustion, so that the gaseous products may be held under compression until so much of their heat has been utilized, the amount of such utilization depending upon the pressure under which they are generated, that, on being allowed to expand, they will be of about the same temperature and in about the same state of elasticity as the surrounding atmosphere.

37,709—February 17, 1863. JOHN D. SMEDLEY. *Improvement in oil stills.*

Claims the use of a large pipe in combination with a small horizontal connecting tube, in any way, by means of which the fluid in the pipe, being kept constantly cool and free from agitation from the still, the quantity of liquid in the still is always correctly indicated.

44,137—September 6, 1864; reissue 1,989—June 13, 1865. WILLIAM ARCHER. *Improvement in distilling hydrocarbon oils.*

Claims the continuous and fractional distillation and separation of hydrocarbon and other oils and volatile substances by the direct application of superheated steam or hot air to the surface of a flowing sheet, column, or shower of the substance to be distilled in the manner described or any modification thereof by which the same result may be accomplished.

49,689—August 29, 1865. JOHN IVES VAUGHAN. *Improved apparatus for the continuous distillation of petroleum, etc.*

Claims the treatment of resins and resinous substances by continued or connected operations, whereby the spirit is distilled from the crude substances and the residual resin volatilized or distilled into a product which becomes solid at the ordinary temperature of the atmosphere without packing or cooling the resins between the operations.

50,935—November 14, 1865. JAMES J. JOHNSTON. *Improved apparatus for evaporating liquids.*

Claims applying heat by means of steam or heated air, separately or combined, to the upper and lower surface of oil or other liquid.

50,935—November 14, 1865; reissue 8,373—August 13, 1878. Division A. JAMES J. JOHNSTON. *Improvement in apparatus for evaporating liquids.*

Claims the combination of a vaporizing chamber, a steam and air superheater communicating therewith, and means for commingling the vapor, steam, and air in a highly heated condition.

52,284—January 30, 1866. H. P. GENGEMBRE. *Improvement in apparatus for extracting oil, etc., from minerals.*

This invention consists in an apparatus so constructed as to submit to the action of a solvent or solvents, in a rational, continuous, and progressive manner, the mineral containing oil, paraffine, or bitumen, and to recover the solvent or solvents by separating it or them from the oil, paraffine, or bitumen by a peculiar distillation.

52,509—February 13, 1866. CHARLES ADAMS. *Improved apparatus for bleaching oil, paraffine, wax, etc.*

This invention consists in an apparatus for bleaching oil, paraffine, or wax, so constructed as to submit these substances, while in the shape of vapors, to the action of steam under pressure, varying at pleasure, whereby all the impurities are removed from the oil, paraffine, or wax, and they are rendered perfectly white without the use of any chemicals.

55,855—June 26, 1866. C. H. HALL. *Improvement of distilling petroleum and other liquids.*

Claims the method herein described of separating the condensable from the noncondensable gases, or any other method whereby the condensable gases are made to collect in the lower part of a receiver while the noncondensable gases are made to pass off by the suction of a current of steam.

55,855—June 26, 1866; reissue 2,470—January 29, 1867. C. H. HALL. *Improved apparatus for distilling petroleum and other liquids.*

This improvement relates to an apparatus particularly designed for refining petroleum oil, but which may be used for refining coal oils, turpentine, or volatile liquids of any description. It consists, first, of a supply tank into which the crude oil or other liquid is first placed to be refined and in which it is partially heated; second, of a retort into which the oil or other liquid flows to be distilled and through which it passes in a thin stratum; third, of a chamber through which the vapors pass into the condenser; fourth, of a condenser in which the volatile portions of the oil or other liquids become condensed; fifth, of a receiver in which the products of condensation are collected and separated from the noncondensable gases; sixth, of a series of water and steam jackets inclosing the condenser in which steam is generated by the heat of the condensing vapors of the oil or other liquid being distilled; seventh, of a series of scrapers carried over the bottom of the retort to prevent the forming of a sediment on said bottom; eighth, of a purifying tank into which the residuum is forced by jet of steam; and, lastly, of a furnace and arch over which the retort is placed.

65,136—May 28, 1867. DEXTER SYMONDS. *Improvement in oil stills.*

Claims in stills for deodorizing and purifying oils where the substance or material used and the process of deodorizing and purifying are herein described, the employment of one or more screens.

68,974—September 17, 1867. SAMUEL GIBBONS. *Improvements in still for refining and distilling oils.*

This invention consists of a retort or still, made cylindrical or any other suitable shape, and placed in a horizontal position. Depending from and connecting with this still at its bottom are two chambers, to which are connected waste pipes. Running into this still from one end, and near its bottom, is a pipe, which is provided with a series of short pipes, which run crosswise of it and of the cylinder, said short pipes being provided with a number of small perforations. Also a pipe which passes down through the still and opens into one of the chambers for the purpose of conveying the oil into the still, and a pipe which communicates with the still at its top, for the purpose of conveying away the vaporized oil.

69,745—October 15, 1867. SAMUEL ANDREWS. *Improved safety valve for oil stills.*

The nature of this invention consists in the construction and application of a safety valve to be placed in the bottom of oil stills as a preventive against the flow of the contents of the still in case of accident of any kind happening to the tar pipe, as in the case of the breaking out of fire in oil refineries it has always been impossible to save the contents of the stills from being consumed, because of the breaking, bursting, or fracturing of the tar pipes from the falling of timbers or débris, or any of the causes incident thereto, and permitting the escape of the entire contents of the stills, thus greatly enhancing the dangers attendant upon the manufacture of oils, etc.; also, in extreme cold weather, pipes frequently burst from that cause and the contents wasted.

91,953—June 29, 1869. FRANCIS McCARTY. *Improvement in the distillation of hydrocarbon oils.*

Claims causing the oil in the still to move in a continuously returning current or flow, by means of a jet of steam, and a funnel inserted in the steam pipe back of the discharging aperture.

110,516—December 27, 1870. SAMUEL VAN SYCKEL. *Improvement in stills for petroleum and other oils.*

The still and furnace are constructed in the ordinary manner, and the dome, preferably of triangular form, is connected with the still. At or near the center of the still, and from the interior of the dome, suspend a series of pipes, connected with the steam boiler, somewhat resembling a gas chandelier. The ends or surfaces of these pipes are perforated, so that jets of steam may be thrown through them into the vapor above the surface of the oil. The dome is for the purpose of conducting the lighter vapors to the pipes connecting with the worm, as they, rising first, will fill the dome and keep the heavier ones from the conducting pipes until the steam jets act upon them.

122,810—January 16, 1872. CHARLES J. T. BURCEY. *Improvement in distilling and bleaching oils.*

Claims the combination of air tube heat chamber revolving hollow heater shaft heaters and hollow perforated arms in the retort.

133,425—November 26, 1872. HIRAM W. FAUCETT. *Improvement in apparatus for distilling hydrocarbons.*

Claims the combination of chemical box dripping pipes, and vapor pipes with condensing cylinder and perforated cylinder.

152,650—June 30, 1874. ROBERT KLOSTERMAN. *Improvement in apparatus for distilling oils, fats, and petroleum.*

Claims the combination of a still, a steam pipe, provided with a water trap, a blow-off cock, and an upwardly inclined nozzle.

156,265—October 27, 1874. J. PARK ALEXANDER AND WILLIAM EBERHARD. *Improvement in oil stills.*

Claims the combination of a still provided with the steam coil, which extends a short distance above the contained oil, provided with inlet pipe, which extends down into and to the bottom of the superheating chamber, a furnace situated a short distance below the still, and independent thereof; and a cylindrical superheater provided at its top with an inlet pipe and exit pipe, which extends down into and to the bottom thereof, said superheater placed entirely within the furnace at its top central portion, and extending from the top down into the furnace to near the bottom, whereby the heat in the furnace is made to pass all around and envelop the superheater on all sides.

168,542—October 5, 1875. CORNELIUS VAN DEVORT AND CORNELIUS VAN FLEET. *Improvement in distilling oils.*

Claims a convex metallic cove provided with a flange and stops in combination with a wooden tub, the flange forming a tight joint.

174,789—March 14, 1876. WILLIAM DOE. *Improvement in oil refineries.*

Claims the combination of still coil pipes, heater, and separator provided with a stirrer.

254,176—February 28, 1882. CHARLES J. TAGLIABUE. *Apparatus for distilling petroleum.*

Claims in an apparatus for distilling oils, the combination of a furnace, a liquid receptacle above the same, an oil tank and vapor chamber, a condenser, a vapor pipe leading from the vapor chamber to the condenser, a vapor pipe leading from the oil tank also to said condenser, an oil lifting pipe extending from the oil tank into the vapor chamber, and a steam pipe uniting at its end with the end of the oil lifting pipe and forming therewith a steam atomizer.

290,866—December 25, 1883. RICHARD DEAN. *Apparatus for distillation.*

Claims the combination with a still and a heater for heating the material before it is distilled, of a steam atomizer located within the still, said atomizer consisting of an oil chamber having an oil supply pipe communicating therewith and orifices opening into the still, a steam chamber provided with steam induction pipe and with small pipes or tubes extending into the oil chamber for atomizing the oil, and a steam coil located below the atomizer.

305,097—September 16, 1884. HENRY McMANUS. *Apparatus for treating refuse from oil refineries.*

The object of this invention is to utilize the waste product from coal oil and petroleum refineries known as "sludge," and which is ordinarily discharged into streams, watercourses, or the ocean. In producing a heavy hydrocarbon oil suitable for lubricating and other purposes, by subjecting the sludge to heat in an apparatus constructed to permit a free circulation, and thorough and uniform heating of the material, however thick and viscid it may be, and regardless of the extent to which it may foam, and claims—

The combination with a lower vessel having a heating apparatus connected thereto, of an upper vessel, a pipe leading from the upper part of the lower to the upper part of the upper vessel, a pipe leading from the lower part of the upper to the lower part of the lower vessel, and pipes leading from both vessels to the condensers.

411,394—September 17, 1889. WILLIAM H. PITT. *Apparatus for distilling crude petroleum.*

Claims the apparatus for distilling and deodorizing petroleum having sulphurous or other offensive odors, said apparatus consisting of a furnace with two fireplaces, a retort over one fireplace, and a deodorizing receptacle over the other fireplace, and a pipe opening into the upper part of the retort and passing down through the retort and out near the bottom of the latter to the said receptacle, which has a discharge outlet for the deodorized vapors.

415,876—November 26, 1889. FRANK W. MINSHALL. *Process of and apparatus for distilling and desulphurizing hydrocarbon oil.*

Claims the process of distilling and desulphurizing volatile hydrocarbon oils, which consists in heating a quantity of hydrocarbon oil of high specific gravity in a still, and injecting a lighter hydrocarbon oil into the still with steam and oxygen, the steam being alternately superheated or wet, according to the temperature of the bath.

431,386—July 1, 1890. THOMSON McGOWAN. *Apparatus for distilling oil.*

Claims the combination, with a still, of a chemical container located inside the still, said chemical container having a feed pipe extending outside the still and having an eduction pipe or opening discharging into the vapor space of the still.

444,833—January 20, 1891. BENJAMIN N. HAWES. *Apparatus for refining oil.*

Claims in an apparatus for refining oils, a steam generator and an oil vaporizing chamber, in combination with a desulphurizing chamber containing gravel or other like substance, an intermediate chamber partially filled with gravel and connected with the desulphurizing chamber and pipes connecting the steam generator and oil vaporizing chamber with said intermediate chamber.

469,777—March 1, 1892. HENRY A. DIEHL. *Production and manufacture of pure asphaltum, etc., from natural asphalt.*

Claims the process of obtaining pure asphaltum, which consists in subjecting the bituminous substance to a sufficient degree of heat in a closed primary retort to melt it, separating from the melted bitumen its earthy and solid impurities, and again submitting the thus purified bitumen to heat in a secondary closed retort to distill it.

477,153—June 14, 1892. CARL MARIA PIELSTICKER. *Distillation of hydrocarbon or other oils.*

Claims in an apparatus for the continuous distillation of oil, a supply tank, a coil, connections between the two, means for heating both tank and coil, means for forcing the liquid from the supply tank through the said coil, a steam jet or blast in connection with said coil, a retort through which the liquid is also forced, said retort being provided with baffle plates and a draw-off cock, a steam ejector fitted to said draw-off cock, a second heating coil in connection with the retort, an expansion chamber connected with one end thereof, a condenser in connection therewith, and a gas holder or other receptacle.

492,421—February 28, 1893. THOMSON McGOWAN. *Still for the distillation and purification of hydrocarbons.*

Claims in a still for the distillation and purification of hydrocarbons, the combination with a still body or shell, of shelf or diaphragm for supporting purifying material, circuitous passages formed for the distillates to pass through, said passages covered or constructed in such a manner that particles dropping from above them are prevented from dropping through them.

507,230—October 24, 1893. ROBERT H. LAIRD. *Process of and apparatus for deodorizing and refining crude oils.*

Claims the process of distilling oil, which consists in first introducing the crude oil to be treated into a vaporizer, then introducing steam at a temperature of substantially 212° to said vaporizer, whereby the alcoholic series of vapors are generated, then withdrawing said vapors, then introducing superheated steam to said vaporizer, whereby the oleic series of vapors are generated, and then withdrawing said vapors as in an apparatus for distilling oil, the combination with a boiler, a series of flues therein, a tubular oil chamber surrounding each of several of said flues, an inlet and an outlet for each of said oil chambers, a pipe affording communication between the steam space of the boiler and the inlet of said oil chambers, a receptacle outside the boiler, and a pipe communicating between said receptacle and said oil chambers.

531,560—December 25, 1894. STANLEY C. PEUCHEN. *Apparatus for vaporizing petroleum or other liquids.*

Claims in an apparatus for vaporizing liquids, a still to contain the liquid to be operated on, an electric heating apparatus for acting on said liquid, means for suspending said electric heating apparatus near the surface of the liquid, and wires connected with said heating apparatus and with the still at about the center of the latter, whereby said heating apparatus may rise and fall equally above and below the center of said still.

556,155—March 10, 1896. WALTER P. LOWE AND CHARLES W. BILFINGER. *Process of and apparatus for distillation of oil.*

Claims an oil still provided at its top portion with a heat-storing and heat-absorbing structure sustained therein, the lower portion of the still forming a receptacle for the collection of drippings from said structure, an oil admission pipe, a steam injector pipe therefor, both of said pipes being located in front of said structure, and a vapor exit pipe.

564,920—July 28, 1896. HERMAN FRASCH. *Apparatus for purifying petroleum.*

Claims in combination with an oil still and a condenser a purifying apparatus comprising a vessel containing a liquid bath, a number of columns of small diameter containing purifying material arranged in said vessel and surrounded by said bath, pipe connections between the vapor space of said still and the column inlets severally, so that every column receives its several portion of vapors given off together from the same body of oil in distillation, pipe connections between the column outlets and said condenser, and exhausters in communication with the said column outlets arranged to aid in counteracting differences in the resistance of the said columns.

629,536—July 25, 1899. ALEXANDER ADIASSEWICH. *Apparatus for distilling petroleum, etc.*

Claims an apparatus for distilling liquid, consisting of a heater, a cylinder heated by the latter, a chamber located at one end of the cylinder and into which the liquid is delivered, and a rotary, tubular shaft having helical scrapers and jet nozzles and extending through, communicating with, and receiving the liquid from said chamber, the liquid entering the shaft and issuing from the jet nozzles against the inside of the cylinder.

645,743—March 20, 1900. FRIEDRICH BERG. *Mineral-oil still.*

Claims a retort or still for vaporizing petroleum, comprising an oil receiving tank having a vapor outlet at the top, heating coils arranged at different elevations, respectively, within the tank, means for supplying and controlling the supply of steam to the said coils, and means for discharging and controlling the discharge of live steam into the tank at different elevations.

749,368—January 12, 1904. ADOLPHE C. G. DUPUIS AND WILLIAM S. FELL. *Distilling apparatus.*

Claims a distilling apparatus, comprising a liquid containing receptacle, the wall of said receptacle having corrugations formed therein, a conical vapor chamber mounted above said receptacle, a foraminous chemical-containing partition between the chamber and the receptacle, upwardly extending converging plates mounted in said chamber, a filling of nonconducting material for said plates, an outlet for the lighter vapors at the apex of said chamber, and outlet conduits for the heavier vapors, lying between the walls of the chamber and the aforesaid converging plates, said conduits converging and joining a common duct outside said chamber.

757,387—April 12, 1904. HORACE W. ASH. *Still for crude bituminous material.*

Claims the combination of a still for distilling crude bituminous material, a compartment at the exterior of the still, a furnace so located as to heat the exterior of the still, the interior of the furnace being in communication with the aforesaid compartment, the compartment being in communication with the interior of the still, whereby the products of combustion may pass from the furnace to the compartment and there heat the exterior of the still, and then pass on and be injected into the interior of the still.

786,828—April 11, 1905. EDWIN A. MOORE. *Tar dehydrater.*

Claims a tar dehydrater consisting of a receptacle provided with a supply pipe, an agitator having a tubular body and tubular arms, trunnions detachably connected to the body of the agitator and provided, respectively, with steam supply and discharge pipes, a detachable head at each end of the receptacle provided with tubular bearings and stuffing boxes for said trunnions, a tar discharge opening in one of the heads of the receptacle and in the plane of the level of the tar, and a condenser.

Subclass 4.—Stirrers and Scrapers.

22,973—February 15, 1859. JOHN NICHOLSON. *Improvement in retorts for distilling oils from coal.*

Claims the use of a curved blade or blades placed on the agitators or arms of a shaft, for the purpose of agitating, lifting, mixing, and bringing all parts of the mass within the retort in contact with the heat. Reissue 712, May 3, 1859. Covers the use of straight as well as curved blades.

23,719—April 19, 1859. WILLIAM SMITH. *Improvement in coal-oil retorts.*

Claims the making of hollow agitating arms, to communicate with a hollow shaft for the purpose of cooling them, by means of a current of air or water passing through the said shaft.

26,326—November 29, 1859. MATTHEW HODKINSON. *Improvement in retorts for distilling coal oil.*

Claims a stationary retort with a shaft armed with knives whose edges are at right angles with the shaft passing through it, by which, when motion is given to the shaft, the coal is broken and pulverized more effectually and more economically than by any other method.

51,042—November 21, 1865. CHARLES A. HARDY. *Improvement in oil stills.*

Claims constructing a still for the distillation of oil and other liquids with an outer chamber enveloping it on the top and at the sides so as to leave a space above and around or partly around the inner or main still, thus forming an outer and inner chamber, communicating with each other by means of one or more siphons or valves, for the purpose of heating the oil or other liquid and vaporizing its lighter constituents before its admission into the main or inner still, and thus effecting an economy of heat.

80,294—July 28, 1868. CHARLES LOCKHART AND JOHN GRACIE. *Improvement in stills for hydrocarbons.*

Claims providing a still for hydrocarbons with a valve, which will act from an internal or external pressure.

80,294—July 28, 1868; reissue 4,515—August 15, 1871. CHARLES LOCKHART AND JOHN GRACIE. *Improvement in stills for hydrocarbons.*

Claims in combination with an upright still a series of fire chambers radially arranged around and under the still, such chambers converging to a central smoke chamber connecting with a flue or chimney.

130,668—August 20, 1872. WILLIAM B. SNOW. *Improvement in apparatus for distilling petroleum.*

Claims the arrangement within a tank of a rock shaft carrying a dasher, a crank rod, and crank arm of a driving shaft for operation.

137,496—April 1, 1873. WILLIAM B. SNOW. *Improvement in oil stills.*

Claims a reciprocating dasher corresponding in contour, as described, with the transverse section of the tank, and arranged to move in a direction longitudinal with the latter, and at a slight but appreciable distance from the heating surface of the tank.

150,465—May 5, 1874. CORNELIUS J. CRONIN. *Improvement in stills for refining oils.*

Claims the improved still for refining petroleum, consisting of a still with end extension chambers, and reciprocating scraper plates for preventing the formation of the sediment on the bottom of the still and carrying the same into the end receptacles.

162,965—May 4, 1875. JOHN L. STEWART. *Improvement in petroleum stills.*

This invention relates to improvements in the construction of apparatus for the continuous distillation of oils of different density from a compartment still, or several stills connected together, and consists in dividing one still into two, three, or more compartments or sections, so that each compartment having separate fires can be heated to the necessary temperature to suit the density of the oil contained therein, and make oil of a different specific gravity from each compartment. These compartments are provided with scrapers secured to endless chains, which are mounted on shafts driven by power. These scrapers remove all sediment and paraffine oil from the bottom of each compartment into a receptacle at the back end, thereby obviating the necessity of having to stop to clean out the stills. Overflow pipes are so arranged in combination with self-acting valves controlled by floats as to carry off the heavy oil from the bottom of one still into the next contiguous still, and thereby maintain constantly the proper level of oil in each compartment. Also in the combination, with a compartment still for continuous distillation, of communicating pipes and automatic regulating valves, whereby the oil in each still is maintained at a proper level; also, in the combination, with a compartment still for continuous distillation, of a pipe or trough conveying the oil from rear pocket of one still to the front end of the next still; also, in making the said pipe as a conduit or lining along the side of the still, to form a lining of running oil between each compartment, and thereby prevent the temperature of one compartment being affected to any great extent by that of the next; also, in the combination, in a compartment still for continuous distillation, of scrapers arranged on endless chains; also, in the particular construction of the scrapers and the mode of connecting them to the chain; and, also, the general combination of parts which go to form the continuous scraping arrangement.

166,349—August 3, 1875. JULIUS C. DICKEY. *Improvement in oil stills.*

Claims a tank provided with an inclined partition in combination with a pump or other forcing apparatus.

209,943—November 12, 1878. OLE TILTON. *Improvement in oil stills.*

Claims in an oil still, a subchamber, provided with inlet openings and discharge tubes.

224,301—February 10, 1880. JAMES D. MEIGHER. *Still for refining petroleum.*

The object of this invention is to prevent all coking or burning of the oil while being vaporized, prevent chilling, preserve a uniform heat through the whole mass, cause more rapid vaporization, and preserve the color of the products, and, in making lubricating oils, to prevent them from chilling and becoming black and stringy, and this is accomplished by the agitation of the whole body of oil by mechanical contrivance while being vaporized by heat, and at the same time introducing a current of heated air into the oil to assist the vaporization and facilitate the flow of vapor through the pipes into the condenser.

252,981—January 31, 1882. GEORGE C. TREWBY AND HENRY W. FENNER. *Distillation of coal tar.*

Claims the apparatus for distilling coal tar, consisting of a main steam pipe with its controlling cock, small branch pipes, ring, lesser branches, and outlets or jets in conjunction with a suitable form of still bottom.

405,738—June 25, 1889. ROSS J. HOFFMAN. *Evaporating apparatus.*

Claims in combination with the still for treating hydrocarbon oils, a steam pipe within said still arranged to substantially cover the surface exposed to the heat, the said pipe being placed close to said surface and being provided with discharge orifices opening directly against the said surface, whereby the jets of steam are caused to impinge directly on the surface to be protected.

490,144—January 17, 1893. HERMAN FRASCH. *Apparatus for refining petroleum.*

Claims the combination with an oil still having a furnace and a flue leading therefrom, of a purifier in the flue, and a feeder adapted to discharge the purifying material among the vapors in said purifier, which purifier communicates with the vapor space of said still and has a vapor exit pipe.

503,996—August 29, 1893. WILLIAM H. STELWAGON. *Tar or petroleum still.*

Claims a tar or petroleum still having a rotary agitator therein, the same being formed of rectangular and tapering vanes, whereby the material in the still may be raised and also directed laterally, and thereby caused to circulate.

553,191—January 14, 1896. HERMAN FRASCH. *Agitator for stills.*

Claims the combination with an oil still, of a number of narrow drags arranged side by side on the still bottom and provided with supporting and scraping edges which rest upon the still bottom in advance of one another and which keep said drags from turning over and conform to the still bottom even when it becomes warped, and means for drawing said drags flatwise over said still bottom while leaving them free to adjust themselves in all directions.

761,315—May 31, 1904. FRANCES B. MERRILL. *Still.*

Claims a horizontal still of uniform section from end to end, its bottom being curved in the arc of a circle described from a point near the top of the still, and the top being contracted, in combination with the pendent vibratory agitator, having a horizontal axis near the top of the still.

Subclass 5.—Condensers.

10,813—April 25, 1854. JAMES R. STAFFORD. *Improvement in distilling and condensing apparatus.*

Claims the employment, for the purpose of separating the more and less volatile products of distillation, of a vessel, which has an opening for the escape or withdrawal of condensed matters, and another opening for the escape of the more volatile matters, and which has its temperature regulated by the admission of steam or air through a pipe, passing through its interior or through a chamber, surrounding it.

24,561—June 28, 1859. WM. G. W. JAEGER. *Improvement in apparatus for condensing coal oil.*

Claims the employment of a fan blower when the same is used to draw the vapors from the retort.

24,561—June 28, 1859; reissue 1,902—March 14, 1865. WM. G. W. JAEGER. *Improvement in condensing and separating oils and gases.*

Claims in apparatus for condensing oils and other liquids, in combination, an annular condensing chamber, through which the vapors of oils and other liquids are to pass as they come from the retort or still, a condensing surface surrounding such chamber, and a condensing surface surrounded by such chamber.

24,920—August 2, 1859. WILLIAM T. BARNES. *Improvement in apparatus for condensing coal oil.*

Claims the employment of a tube, the lower extremity of which is provided with tubular arms, the same being made to revolve, and being used in connection with a tank partially filled with water, and a conducting pipe.

28,246—May 15, 1860. LUTHER ATWOOD. *Improvement in construction of apparatus for the redistillation of coal oils.*

Claims a separating chamber constructed when arranged and combined with a volatile oil still and condenser in such manner as to gradually separate and condense the heavier parts of the oleaginous vapors formed and continuously return them to the still for a further action of the heat, and at the same time preserve the lighter vapors and pass them over to the condenser.

28,341—May 22, 1860. JOHN F. BENNETT. *Improvement in apparatus for condensing coal oil.*

Claims subjecting the volatile products of the distillation of coal (composed of a mixture of various substances in the form of vapor) directly as it passes from the retort or prime generator to gradually diminishing degrees of heat in a succession of condensers, for the purpose of separating by one operation each of these several different substances from the other substances with which it is mixed when in the form of vapor, at the particular degree of temperature at which it assumes the liquid form as distinguished from the fluid or gaseous form, by means of an apparatus such as described when combined with a coal oil retort.

31,858—March 26, 1861. LUTHER ATWOOD. *Improvement in the manufacture of hydrocarbon oils.*

Claims the direct application of ice or ice and salt to the condensation of hydrocarbon oil vapors.

31,998—April 9, 1861. ABRAHAM QUINN. *Improvement in apparatus for distilling oils.*

Claims the rectifier composed of an inverted siphon with its faucets and other appendages, applied, in combination with still and condenser, in such manner as to be capable of effecting the several operations and purposes.

35,497—June 10, 1862. JAMES ADAIR. *Improvement in condensers for oil stills.*

Claims so constructing the worm chest of the condenser as to separate the different qualities of oil by partitions, which the condensed fluid can not pass, but which present no obstacle to the flow of the uncondensed vapor and gas through the worm.

36,403—September 9, 1862. CHARLES W. GRANNIS. *Improved condenser for coal oil stills.*

Claims a condenser which combines the following features, to wit: First, sloping sides; second, an internal trough to catch and conduct the condensed vapors to an external conductor; third, an external spout or conductor passing through or in a trough of cold water to conduct the condensed vapors to the worm or cooler; fourth, jets of water or a body of cold water upon its outside, in combination with a caldron or still having a broad open top, upon which the condenser is fitted, forming a cover thereto, so that the vapors arising from the entire surface of the oil in the still may pass directly to the condenser.

36,481—September 16, 1862. ABRAHAM QUINN. *Improvement in apparatus for distilling petroleum and other oils.*

Claims the arrangement of several rectifiers in combination with each other, with the still retort, and with the device or apparatus for feeding the crude oil in such manner that the vapors of the heavier oils on their way to the condensing apparatus meet the crude oil on its way toward the still retort and heat the latter oil to such an extent as to extract the vapor of the more volatile portions of it before it arrives at the retort of the still.

37,263—December 23, 1862. THOMAS K. PETTY AND WILLIAM G. WARDEN. *Improvement in oil stills.*

Claims the use in stills for distilling hydrocarbon oils, of a double trap, so connected with the still and its worm pipe or goose neck as not to return to the still the heavier vapors or any condensed products of distillation, but so that any unvaporized liquid or solid substances carried over with the vapor, or boiling over from the still, through the still head or goose neck, shall be arrested before reaching the worm or condenser, and either returned to the still or collected in a separate receptacle.

39,978—September 15, 1863. I. W. WETMORE. *Improved apparatus for condensing oil vapors.*

Claims the separate upward flowing currents above and below the vapor chamber, the propulsion of these currents on the principle of the siphon, the corrugation of the upper condensing surface, the breaks of wooden angles and doors in the vapor chamber, and a sprinkler.

47,235—April 11, 1865. CYRUS M. WARREN. *Improved apparatus for distilling petroleum, etc.*

Claims the special application of heat by means of a separate fire or its equivalent to a condenser attached to a still, for the purpose of controlling and regulating the temperatures of the vapors given off in distillation, in order to produce a more complete separation of the constituents of complex mixtures of liquids.

48,435—June 27, 1865. ELIJAH FREEMAN PRENTISS AND ROBERT ADAM ROBERTSON. *Improved apparatus for distilling petroleum.*

Claims the employment of bent vapor, steam, and air pipes, arranged, constructed, and operating substantially as shown and described.

49,020—July 25, 1865. L. N. WILCOX. *Improved apparatus for separating the products of distillation of hydrocarbons.*

Claims separating benzole from illuminating oils in distilling hydrocarbon oils and other substances by means of separate pipes arranged with traps, leading off from different parts of the condenser.

50,368—October 10, 1865. A. KREUSLER. *Improved apparatus for distilling petroleum.*

Claims the use of a series of adjoining condensing chambers, arranged substantially as described, for the purpose of separating the condensed liquids of different specific gravity.

52,277—January 30, 1866. SOLOMON B. ELLITHORP. *Improved refrigerator and condenser.*

Claims a refrigerator or condenser for cooling liquors or condensing vapors, consisting of an outer chamber, an inner chamber, and a system of perforated pipes.

53,528—March 27, 1866. J. H. FAIRCHILD. *Improved condenser.*

Claims a basin and perforated condensing pipe in combination with a water pipe and vapor pipe.

58,005—September 11, 1866. P. H. VANDER WEYDE. *Improvement in distilling petroleum and other liquids.*

Claims the production of a partial vacuum by suction produced in the still by a pump either between it and the condenser, or at the end of the tube intended for the escape of the noncondensable products, which vacuum may be filled by those noncondensable products—vapor, air, or steam—led to and admitted from the other end of the apparatus, provided with a safety valve.

60,166—December 4, 1866. ANDRE FOUBERT. *Improvement in distilling and refining oils, wines, and other liquids.*

Claims a column containing perforated diaphragms in combination with a worm or condenser and pipe passing back to the column.

61,120—January 8, 1867. ALEXIS THIRAULT. *Improvement in distilling petroleum.*

Claims the apparatus constructed to secure a continuous distillation by one single operation, being a combination of boilers and tar cock with hot-air chamber and all the pipes and other parts composing the said apparatus.

63,963—April 16, 1867. ALEXIS THIRAULT. *Improved apparatus for treating petroleum.*

Claims the arrangement of one or more steam jets in combination with a condensing coil.

65,884—June 18, 1867. SAMUEL DAVIS. *Improved mode of condensing noxious vapors from lard rendering, etc.*

Claims discharging a stream of water into the discharge pipe of a boiler, for the purpose of increasing the draught from the boiler.

66,243—July 2, 1867. CLARENCE MORFIT. *Improvement in condensers for stills.*

Claims a condenser, which is adapted for use in conjunction with a still, and which is divided into a number of chambers communicating with each other and provided with two series of pipes or conduits, so arranged as to admit of the separation and revaporization of the distillates and their return to the still.

68,257—August 27, 1867. CHARLES STOTT. *Improved apparatus for distilling and rectifying petroleum.*

Claims an apparatus for distilling and rectifying petroleum, in which steam is used in the still, or retort and rectifier.

86,232—January 26, 1869. C. M. JAMES. *Improved apparatus for distilling volatile hydrocarbons and other substances.*

Claims an arrangement of mechanism, by means of which the substance to be distilled, and the vapor to be condensed, either or both, are operated upon when extended in thin sheets or strata.

96,997—November 16, 1869. AUGUSTUS HENRY TAIT. *Improvement in stills for distilling naphtha and petroleum.*

This invention consists in a supplementary or ascending worm, and a condenser, placed over the still proper, up to or into which ascends all the vapors that are generated, and, where they become separated into light and heavy vapors, the heavy vapors falling back into the still, leaving the lighter vapors in the worm or supplementary condenser, whence they pass into a second condensing apparatus, where they are finally condensed, the naphtha or light oils formed from them being gathered into a suitable receiver.

117,426—July 25, 1871. JAMES J. JOHNSTON. *Improvement in processes and apparatus for treating hydrocarbon oils.*

Claims the combination of pipes constructed and arranged with relation to each other and a condenser, substantially as described.

117,873—August 8, 1871. HIRAM W. FAUCETT AND THOMSON McGOWAN. *Improvement in condensers for oil stills.*

Claims a longitudinal cylindrical perforated pipe, arranged within the condensing cylinder and communicating with the feed pipe in combination with vapor pipes surrounded by water in water box and operating in reference to the still.

118,602—August 29, 1871. ANDRE FOUBERT. *Improvement in apparatus for distilling and refining oils.*

This invention is especially for the refining of petroleum and separating the same into gasoline or naphtha, burning oil, and refuse coloring matter, and consists in the use of a column, somewhat similar to that employed in a rectifying apparatus for alcohol, the parts being arranged so that the burning oils may be returned to the still or drawn off separately, and the gasoline or naphtha is condensed until the lighter oils are distilled entirely, after which the burning oil can be distilled. During the distillation the coloring matter and thick heavy oils are to be conveyed away to a separate receptacle, so that there may be no tar, heavy oil, or similar material to obstruct the apparatus when it is allowed to cool, or after each charge of the apparatus.

120,539—October 31, 1871. HENRY H. ROGERS. *Improvement in distilling naphtha and other hydrocarbon liquids.*

This invention consists in an apparatus for separating volatile hydrocarbons by repeated vaporization and condensation. The operation is continuous, and what is equivalent to a large number of fractional distillations is accomplished during a single distillation. The apparatus used is, in many respects, similar to what is known as the column still for distilling alcoholic spirits, but modified in all the details, so as to make it available for distilling oils. In the spirit still it is only required to separate two principal liquids—alcohol and water. But in the oil still a long series of liquids is to be separated.

123,907—February 20, 1872. SAMUEL HUDSON. *Improvement in distilling coal oils.*

Claims in distilling burning oil from petroleum, the use of a condenser of a temperature as high as the fire test of the oil, and passing away the uncondensed vapors freely and directly to the atmosphere.

132,263—October 15, 1872. CHARLES W. DURANT AND JOHN GRIFFITH. *Improvement in condensers for vacuum pans, etc.*

Claims the arrangement of a cooling jacket or apron between the vapor supply pipe of a condenser, and the injection pipe, said jacket or apron being made to dip beneath the bottom end of the injection pipe in the condenser.

133,426—November 26, 1872. HIRAM W. FAUCETT AND THOMSON McGOWAN. *Improvement in apparatus for refining hydrocarbon oils.*

Claims the arrangement of a supply pipe, injecting pipes, and vapor pipes, combined and operating in connection with a still and water box.

143,945—October 21, 1873. SAMUEL VAN SYCKEL. *Improvement in apparatus and processes for treating petroleum.*

Claims the process of treating crude petroleum with the resultant product of only oil and gas, by effecting the condensation of the oleaginous vapors, and the immediate return of the condensed product to the body of oil in the treating chamber, and carrying over only the uncondensable gases; and,

The combination of a vertical chamber, for treating crude oil, furnished at or near its lower end with a pipe or pipes for the admission of steam, and a condensing chamber arranged above, with condensing pipes for condensing the oily vapors, and a gas pipe from the dome or chamber above for carrying off the uncondensed gases.

154,771—September 8, 1874. SAMUEL VAN SYCKEL. *Improvement in condensers for hydrocarbons.*

Claims in combination with a vertical condensing chamber, a vapor pipe admitting the vapors at or near its upper end, a water spray pipe discharging upward at or near its lower end, and a supplemental tubular condenser.

156,899—November 17, 1874. REUBEN D. TURNER. *Improvement in apparatus for refining oils.*

Claims the combination of oil evaporator, steam jacket perforated mixing chamber for the vapors of the oil and steam, drip pipe, and one or more condensers, all being arranged for operation.

168,060—September 21, 1875. ROBERT SPEIR AND JOHN MATHER. *Improvement in apparatus for condensing vapors, gases, etc.*

Claims the apparatus consisting of the shelves, blocks, provided with tapered openings, baffle plates, pipes and tanks, all combined and operating together.

170,730—December 7, 1875. MILO HARRIS. *Improvement in condensers for stills and drying chambers.*

Claims the combination, in an evaporating chamber, of a spiral or rabbeted condenser, having a longer vertical than horizontal dimension in its cross section, and having its inlet and outlet extended outside of the chamber, with a correspondingly spiral or rabbeted trough, to catch and convey the condensation.

213,395—March 18, 1879. JOHN DAUL. *Improvement in apparatus for rectifying petroleum.*

Claims in combination with a still rectifier and condenser, the separator with a pipe, for conducting the oil directly back to the still, and the attached pipe, for drawing off the water.

217,995—July 29, 1879. JOHN W. CULMER. *Improvement in apparatus for separating hydrocarbon oils.*

Claims in a separator condenser for hydrocarbons, a worm consisting of two or more straight pipes connected at recurring lower levels by couplings forming cross pipes in combination with a trap receiver, for each cross pipe and a separate tail pipe, having the upward bend between said trap receiver and the outflow end of said tail pipe.

224,037—February 3, 1880. JOHN H. NICOLAI AND WILLIAM F. NICOLAI. *Coal oil condensing and separating apparatus.*

This invention relates to means for separating the distillate from coal oil or petroleum stills into fluid bodies differing in specific gravity; and it consists in a worm tub or cooling vat and a closed separator provided with a pipe leading from the separator to the exterior of the vat, and having a worm section leading from the still to the separator, and also other worm sections leading from suitable parts of said separator to nozzles at the lower part of the vat, by means of which a heavy burning fluid and a light hydrocarbon are delivered from the respective nozzles at the same time.

226,151—April 6, 1880. WILLIAM ATWOOD. *Distillation of oils.*

Claims the combination, with a still for vaporizing hydrocarbon oil, of a condenser inclined upward from the dome or goose neck of the still, to cause the vapors condensing therein to flow back through the upward current of uncondensed hot vapors, a refrigerator or cooler connecting with the lower end of the inclined condenser by a pipe provided with a trap to prevent the passage of uncondensed vapor or gases through the refrigerator.

229,297—June 29, 1880. JAMES H. ALEXANDER. *Process of refining petroleum, etc.*

Claims the method of separating the products of distillation into several grades which consists in conducting the vapors from the still into a common receptacle wherein the vapors are allowed to separate, as such, by their own gravities, and then conducting them, according to their gravities, to separate condensing worms.

230,239—July 20, 1880. SAMUEL CHENEY. *Process and apparatus for distilling petroleum.*

Claims the process of producing lubricating oil from crude petroleum placed in a digester by driving off the gas with steam at a pressure of about 40 pounds and that portion of the petroleum adapted for illuminating oil by the action of live steam at a pressure of not over 75 pounds, allowing the heavy oil to cool, heating it and agitating it a second time by live steam at the pressure last mentioned, allowing it to cool, and heating it and agitating it by steam a third time, and then cooling the heavy or lubricating oil, with its condensed water, as slowly as practicable in receivers; and,

A separator made to receive condensed liquid from distillate of petroleum and water, constructed with inclined sides, partition inclined shelf, and waterway with its gate.

239,618—April 5, 1881. ALBERT NEILSON. *Process of and apparatus for distilling petroleum products.*

Claims the method of separating the products of petroleum by distillation, consisting in subjecting the vapors to the condensing action of one or more diaphragms of water attempered to condense the desired constituent of the oil and permit the passage of the next more volatile constituent to the condenser.

243,496—June 28, 1881. OTTO BRAUN. *Cooling apparatus for condensing vapors.*

Claims in a cooling apparatus a cooling pipe suspended from a plate and contracted at the upper end.

243,930—July 5, 1881. THOMAS MARRIN. *Apparatus for refining petroleum and tar.*

Claims the combination, in a refinery, of a tank, a series of siphon pipes having their lower end immersed in a cooling liquid in said tank, an elevated connecting pipe uniting the upper end or longest leg of the siphons, and pipe with the benzine tank, steam coil therein, and gas holder.

254,990—March 14, 1882. JOHN N. MARTIN. *Process of and apparatus for distilling oil.*

Claims the improvement in the process of distilling oil which consists in separating the primary distillate from the still into oil and vapor, partially or wholly condensing such vapor, then separating the resulting condensed products into oil and light vapor by subjecting them to the action of the primary hot vapor distillate, and finally conducting away and condensing separately the light and heavy products.

258,284—May 23, 1882. LOUIS DAUL. *Apparatus for rectifying petroleum.*

Claims in an apparatus for rectifying petroleum, in combination with the main portion or walls, perforated plates, pipes, and cup, the coils or worms situated just beneath plates and the hot water tank, and pipe connecting the worms with such tanks.

281,045—July 10, 1883. HERMAN FRASCH. *Process of and apparatus for the fractional distillation of hydrocarbon oils.*

Claims a process for the fractional distillation of hydrocarbon oils, consisting in introducing into the vapor from the still a vapor for which hydrocarbon oil has little or no affinity, and passing together such vapors through a series of condensers of different temperatures, and,

In an apparatus for the fractional distillation of hydrocarbon oils, the combination with a condenser provided with a vapor conduit, of pipes for supplying mixed vapor of hydrocarbon oils and steam or equivalent vapor to the lower portion of the condenser.

298,210—May 6, 1884. EDWARD KELLS. *Apparatus for distilling petroleum.*

Claims in combination, water box or tank, receiving box or boxes, immersed therein, condensing pipes opening into the receiving boxes, and discharge pipe provided with a bent tube, fixed to its underside.

309,027—December 9, 1884. CHARLES ANTHONY BURGHARDT. *Apparatus for condensing naphtha and other vapors.*

Claims a condenser or section of a condenser for use in the recovery of india rubber solvents and for other uses, divided into compartments by means of partitions of wire gauze or perforated plates extending through the shell or walls of the condenser into the body of cooling liquid outside the condenser.

310,497—January 6, 1885. RICHARD DEAN. *Process of and apparatus for the fractional distillation of petroleum.*

Claims in the fractional distillation of petroleum, the process consisting in passing the vapor from the still through condensing tubes or conduits (one or more), and conducting the uncondensed vapors backwardly in direct contact with said tubes or conduits, and thence into a condenser, whereby the uncondensed vapor serves as the sole condensing bath or medium for the vapor coming from the still, and drawing off the liquid condensed in said primary condensing tubes or conduits; and,

In an apparatus for the fractional distillation of petroleum, the combination, with a still and condensing tubes or conduits (one or more) communicating therewith, of a chamber inclosing said condensing tubes or conduits, and constructed and arranged to convey the uncondensed vapor issuing from the said tubes or conduits backwardly in direct contact therewith, and constitute the sole condensing medium therefor, a condenser connected with said inclosing chamber, and pipes for drawing off the liquid from the condensing tubes or conduits.

313,979—March 17, 1885. JOHN E. BICKNELL. *Apparatus for separating oil vapors.*

Claims the separation of the different grades of oil contained in one common invention which consists in a special construction having the object to insure the certain condensation of the vapors of the heavy oil, while the vapors of lighter specific gravity pass off separately, and also in means for accurately regulating the temperature of the condenser at all times.

389,988—September 25, 1888. CHARLES F. THUMM. *Refining petroleum.*

Claims the combination, with primary furnace and its retorts, of injector, and provision for admitting air, and a series of successive condensers and trap pipes leading from the same, and the retort wherein the oil is initially heated, the same being connected with the decomposing retort in the primary furnace by means of a trap pipe.

426,173—April 22, 1890. JAMES DEWAR AND BOVERTON REDWOOD. *Apparatus for the distillation of mineral oils and like products.*

Claims in an apparatus for distilling oil, the combination of the retort, the still head, in free communication with the retort, the condenser in free communication with the still head and provided with a regulated outlet, the oil pump having a pipe leading into the retort and extending nearly its full length, and the air compressing pump having a pipe communicating with the still head.

471,291—March 22, 1892. JOHN LAING. *Apparatus for destructive distillation of mineral oils.*

Claims the combination, with a still for the destructive distillation of mineral oils, of a loaded outlet valve and a relief tank interposed between the said outlet valve and an ordinary condenser, the said relief tank being used more or less as a condenser.

486,554—November 22, 1892. HENRY S. BLACKMORE. *Condenser.*

Claims in a condenser, the combination of an inverted conical outer vessel having an inlet pipe and a discharge pipe at its lower end portion and an inlet pipe at its upper end portion, the inverted conical inner vessel, having its exterior provided with a spiral flange, which gradually diminishes from the large to the small end of the inner vessel and has its outer edge in juxtaposition to the inner surface of the outer vessel, means for rotating the inner vessel, with its diminishing spiral flange, to force the condensed material toward the discharge pipe of the outer vessel, a movable cover and a water jacket surrounding the outer vessel and provided with a lower inlet pipe and an upper outlet pipe.

530,300—December 4, 1894. ALLEN H. DUNKLE. *Vapor condenser.*

Claims the condensing chamber provided with inlet and outlet openings, in combination with a central water pipe and a coiled water pipe, the ends of said water pipes projecting through the closed top of the condensing chamber and discharging thereon so as to overflow the exterior of the chamber.

596,874—January 4, 1898. HARRY W. HAND. *Condenser, distiller, and feed-water heater.*

Claims the combination in an apparatus for condensing, distilling, or heating feed-water, of a casing, a series of tubes, and tube-plates so arranged as to be detachable from the casing and forming a removable tube structure, with deflecting-plates carried by the removable tube structure.

619,512—February 14, 1899. ADAM SLUCKI. *Apparatus for heating or cooling gaseous media.*

Claims in an apparatus for heating or cooling fluids the combination of tubes forming a conducting way for one medium, a casing inclosing said tubes, and corrugated partitions separating the tubes, the crests of the corrugations extending between tubes nearly to the plane of the axis thereof, whereby thin spaces are formed around tubes and connecting slits, said slits and spaces forming a way or conduit for a second medium.

622,936—April 11, 1899. JAMES R. WHITING AND WILLIAM A. LAWRENCE. *Apparatus for separating and recovering valuable vapors.*

Claims an apparatus for recovering or restoring vapors to liquid form, comprising a main receiver, a refrigerator, a pipe leading from the main receiver into a coil in the refrigerator, a collecting vessel in said refrigerator, with the interior of which the coil communicates, a trapped pipe leading from the lower portion of said collecting vessel to another receiver, a vapor receiver having a valve controlled pipe connection with the upper end of the collecting vessel, a pump having a pipe connection with the vapor receiver, an air-tight tank for containing a liquid, a pipe leading from the pump to the bottom of said tank and having a perforated horizontally disposed portion, a coil in said tank communicating with and receiving the drip from the refrigerator, an air discharge pipe leading from the said tank, and a pipe leading from the upper portion of said tank to the said other receiver.

700,373—May 20, 1902. JOHN S. ROAKE. *Distilling apparatus.*

Claims in an apparatus of the character described, a condenser coil, a pipe leading from a retort, an elbow connecting said pipe and the coil, a boss on said elbow, a tapered casing detachably mounted on said boss, a jet nozzle extending into said casing and connected with a source of steam supply, a pipe connecting said casing with an elevated tank, and a pipe also connected to said casing and with an open funnel.

727,391—May 5, 1903. WILLIAM T. LEMAN. *Condenser.*

Claims a condenser comprising a casing having a plurality of flues extending therethrough, means for passing a cooling agent through said flues, means for admitting vapor into said casing at one side thereof, and an annular baffle plate arranged between the flues within said casing adapted to compel the vapors to pass around parallel to the outer wall thereof across the path of the outer flues, said baffle plate being apertured on the opposite side thereof to admit the vapors into the space within the same and into contact with the inner flues.

755,760—March 29, 1904. LOUIS GATHMANN. *Apparatus for distilling petroleum.*

Claims in a distilling apparatus, the combination of a liquid-heating means; a vaporizer in communication therewith; a condenser communicating therewith; means favoring the radiation of heat from the top walls only of said condenser; and means for drawing off fractions of the condensate along the course of said condenser.

Subclass 6.—Bottoms.

24,217—May 31, 1859. WILLIAM G. W. JAEGER. *Improvement in retorts for distilling oil from coal.*

Consists in providing certain side channels at the side of the retort and arching the bottom so that the heavier oils may be drawn off before they are charred.

32,557—June 18, 1861. J. G. COLLINS. *Improved method of securing bottoms to stills.*

Claims a ring or clamp in combination with the bottom and a flange, each formed and constructed as described.

32,704—July 2, 1861. JOSHUA MERRILL. *Improvement in the distillation of hydrocarbon oils.*

In the distillation of hydrocarbon illuminating oils from crude coal oil or petroleum it is customary to place caustic soda or caustic potash in the still for the purpose of removing undesirable matters from the oil. This practice, although apparently necessary to the production of good oil, is very destructive to still bottoms, which, being covered with the alkali, burn out rapidly. There is also a loss of fuel in heating the oil through the layer of alkali.

This invention consists in a mode of using caustic alkali within the still and in direct contact with the boiling oil without suffering it to lie on the still bottom by placing the alkali in a pan of suitable size and adapted for the purpose.

32,706—July 2, 1861. JOSHUA MERRILL. *Improvement in the construction of stills.*

Claims the still, as a whole, consisting of a cast iron top, wrought iron sides, and wrought iron seamless bottom, combined together by angle iron couplings, for the purpose of making a comparatively light and durable hydrocarbon-oil still.

33,955—December 17, 1861. JOSHUA MERRILL. *Improvement in constructing stills and still bottoms.*

This invention consists in a new kind of still bottom, viz. a formed seamless steel still bottom, and in combining it with the body of a still.

35,819—July 8, 1862. JACOB REESE. *Improvement in furnaces for coal oil stills.*

Claims the mode of constructing stills, the bottom of which is composed of more than one piece, and furnaces therefor in such manner that all the joints, seams, and rivets which are placed inside of the fire chamber shall rest upon or be covered by walls or supports of brickwork or cement, and thus protected from the direct action of the fire.

38,602—May 19, 1863. JACOB REESE. *Improvement in oil stills.*

Claims the use, in combination with the guttered fire walls inclosing the joints of the still, of air flues for the purpose of passing a current of cold air along and over so much of the joints and rivets of stills as are situate in that part of the still which is situate within the fire chamber of the furnace, and thereby preventing the opening of the joints and carrying off any oil which may leak from the still; and,

The use of two or more goose necks in a single still, where the still is so constructed as that a separate vapor space is formed for each goose neck, while the fluid distillate is allowed to pass freely between the compartments thus formed.

46,088—January 31, 1865. GEORGE H. S. DUFFUS. *Improvement in retorts for distilling petroleum.*

Claims in stills for rectifying petroleum and other oils, or producing illuminating or other oils or gases from any substances capable of treatment by heat, making the bottom of the retort with a dome, or its equivalent, rising therefrom up within its interior.

46,090—January 31, 1865. GEORGE H. S. DUFFUS. *Improvement in retorts for distilling petroleum.*

Claims in stills for rectifying petroleum, or in which oils, coal, or other substances are treated by heat, arranging the furnace or burner by which the heat is communicated or created so that it and the flames or incandescent fuel can be moved nearer to and farther away from the retort, according to the condition of the work.

61,291—January 15, 1867. WILLIAM C. WELLES. *Improved still for petroleum.*

The present invention consists, first, in securing the fire sheets or plates to the bottom of the still through the medium of a frame, whereby many important advantages are secured, and, second, in a novel arrangement of the furnace flues under the still, whereby the products of combustion after leaving the fire chamber are made to pass over the entire surface of the bottom of the still, thus effecting not only a great economy in coal, but diffusing a greater proportion of heat, and producing a much better quality of oil.

102,186—April 19, 1870. JOHN WARREN. *Improvement in stills for petroleum.*

The object of this invention is to furnish an adjustable standard or support for the still bottom, and also to provide for the opening or closing of the upper end of the tar pipe, at its point of connection with the still.

117,425—July 25, 1871. JAMES J. JOHNSTON. *Improvement in apparatus for distilling hydrocarbons.*

Claims a still with a corrugated heating surface, in which is a series of oil chambers elevated one above the other, and so arranged with relation to each other that the oil shall flow from the upper chamber in a broad thin sheet over a convexed surface into the chamber next below it, and thus flow down from one chamber to the other through the whole series.

136,557—March 4, 1873. JOHN L. STEWART AND JOHN B. DUBLER. *Improvement in oil stills.*

This invention consists chiefly in the mode of bracing the still, and supporting it over the fire; also in the device for returning the condensed oil back to the still; also, the construction and arrangement of the fire and brickwork.

142,515—September 2, 1873. HENRY RYDER. *Improvement in apparatus for distilling heavy oils.*

The main purpose of this improvement is to prevent, in a still, the collecting of carbonaceous or other heavy deposits on the surface directly over that exposed to the direct action of the flame of the fuel in the furnace.

It is frequently the case, with coal oil stills of ordinary construction, that the deposits on their bottoms are so great and become so hard and thick as not only to become a means of preventing the heat of the furnace from being absorbed by the contents of the still, but of so insulating the bottom of the still from the oily contents as to enable such bottom soon to be burned through or injured more or less by the fire.

191,406—May 29, 1877. JOHN T. COLEMAN. *Improvement in oil stills.*

Claims a cylindrical sheet metal still, divided longitudinally into sections, the said sections being connected together by continuous internal or inwardly turned flanges, the said flanges having pronounced rounded corners and connected by rivets.

213,157—March 11, 1879. CLARK ALVORD. *Improvement in oil stills.*

Claims the combination, with an oil still, of a series of metal rods fixed in the bottom of the same and extending up into the body of the oil.

492,419—February 28, 1893. THOMSON McGOWAN. *Still lining.*

Claims an inside lining or covering for stills consisting of an absorbent and practically noninflammable and indestructible material; and,

An inside lining or covering for stills consisting of mineral wool impregnated or saturated with plumbate of soda.

504,917—September 12, 1893. JOHN FREEL. *Retort for stills.*

In practice great trouble has been caused by reason of the incrustation of the bottom of the retort, owing to the accumulation thereon of the solid matters contained in the crude oil, and of the accumulation of solid deodorizing compounds which it is usual to place in the oil during the distilling process. This incrustation necessitates the frequent renewal of the bottom of the retort, thus entailing considerable expense.

The object of this invention is to overcome this objectionable incrustation, and it consists in providing the retort with a false bottom adapted to retain the solid matters, and constructed to permit a free circulation of the oil, so that the latter will act as a conductor of heat between the main and false bottoms, and will serve to prevent the flame from acting injuriously upon the retort.

The invention also consists in combining with the false bottom an agitating device arranged to stir or agitate the solid matters thereon.

Subclass 7.—Feeders.

33,699—November 12, 1861. H. P. GENGEMBRE. *Improvement in apparatus for distilling coal oils.*

This invention consists in certain means of feeding the still, by which the oil is delivered thereinto at a high temperature as fast as the distillation proceeds, so that the quantity in the still is always nearly the same, and by which the boiling over of the still is prevented.

41,858—March 8, 1864. ELIJAH FREEMAN PRENTISS AND ROBERT ADAM ROBERTSON. *Improved apparatus for distilling rock oil and other hydrocarbons.*

Claims the combination of a still with a series of columns, three or more; each column being set and maintained at the temperature necessary to separate the product condensable at such temperature, whereby at one continuous operation the crude oil is separated into the various products due to condensation at the different temperatures fixed upon.

41,858—March 8, 1864; reissue 2,316—July 17, 1866. Division 1. ELIJAH FREEMAN PRENTISS AND ROBERT ADAM ROBERTSON. *Improved process for distilling rock oil and other hydrocarbons.*

Claims feeding crude oil into the still through one or more condensers, so that the crude oil serves as a surface condensing bath to the oil vapor coming from the still, and at the same time the crude oil itself undergoes a separate partial distillation before reaching the main still.

41,858—March 8, 1864; reissue 2,317—July 17, 1866. Division 2. ELIJAH FREEMAN PRENTISS AND ROBERT ADAM ROBERTSON. *Improved apparatus for distilling rock oil and other hydrocarbons.*

Claims the combination of a still with a series of columns, two or more, each column being set and maintained at the temperature necessary to separate the product condensable at such temperature, whereby at one continuous operation the crude oil is separated into the various products due to condensation at the different temperatures fixed upon.

46,899—March 21, 1865. CHARLES A. HARDY. *Improved still for oils, etc.*

Claims the arrangement and combination of parts in a diaphragm still, consisting of float valves governing the inlets to the upper and lower compartments, respectively, and heads communicating with the separate escape pipes.

54,358—May 1, 1866. WILLIAM G. W. JAEGER. *Improved apparatus for continuous distillation.*

Claims in a distilling apparatus, drawing off from the bottom of the still continuously, or as often as required, the heavy oils and residuous matters of the charge, and at the same time feeding the still as the charge is reduced by a supply through a pipe which traverses or passes through that portion of the charge which is being withdrawn.

154,700—September 1, 1874. THOMSON McGOWAN AND SAMUEL VAN SYCKEL. *Improvement in feed pipes for oil stills.*

Claims a perforated coil pipe arranged within a still and connected with a feed pipe, whereby the hydrocarbons introduced are vaporized and allowed to escape through the perforations in the order of their respective gravities, as the hydrocarbon traverses the pipe.

544,516—August 13, 1895. ODILON PERRIER. *Method of and apparatus for continuous distillation of crude hydrocarbons, etc.*

Claims the method of distilling crude, liquid hydrocarbons in a continuous manner, for the purpose of facilitating the disengagement of the more volatile products at a comparatively low temperature, which consists in subjecting an inclosed current of the liquid, at one point in its flow, to agitation at a comparatively low temperature, in such a manner as to expose the liquid in thin films, then exposing the liquid, at a farther point in its flow to heat sufficient to vaporize it, and finally leading the hot vapors so generated back to the point where the agitation is proceeding.

Subclass 8.—Films.

44,137—September 6, 1864. WILLIAM ARCHER. *Improvement in distilling hydrocarbon oils.*

Claims continuously and fractionally distilling and separating the various parts of hydrocarbon oils by the application of superheated steam or heated air.

44,481—September 27, 1864. WILLIAM ARCHER. *Improvement in refining hydrocarbon oils.*

Claims the arrangement of machinery by which a thin sheet or film of hydrocarbon oil is by centrifugal action continuously made to flow over, and to become thoroughly permeated and cleansed by a volume of sulphuric acid or other purifying element.

53,964—April 17, 1866. L. V. FICHET. *Improved apparatus for distilling petroleum.*

This invention relates to an apparatus composed of a hollow drum and steam coil, which are heated by superheated steam and surrounded or covered by a suitable jacket, in combination with a helical trough commencing on the top of the steam drum and extending down to its bottom in such a manner that crude petroleum or other liquids let into the top end of the helical trough are gradually heated and partially evaporated, and those parts of said liquids which reach the bottom end of the troughs in a liquid state drip down upon the highly heated steam coil, where they constantly flash into vapors, and the distillation of petroleum or other liquids can thus be conducted without interruption and without danger of an explosion or conflagration.

55,071—May 29, 1866. SILAS R. DIVINE AND CHARLES A. SEELY. *Improvement in apparatus for distilling.*

This invention consists in providing the interior of the body or shell of a still with a pipe leading gradually to the bottom of the still, said pipe acting as the heating surface, and being wholly or partly surrounded with a channel along which the liquid to be vaporized shall flow.

58,813—October 16, 1866. C. H. HALL AND JOHN ELLIS. *Improved distilling apparatus.*

Claims passing the vapors through a closed vessel containing a pipe or pipes through which cold water passes, said vessel being provided with one or more discharge pipes to draw out the condensed liquid of any desired gravity.

63,789—April 16, 1867. JOHN ELLIS AND EDWARD C. KATTEL. *Improved apparatus for distilling and refining petroleum, etc.*

Claims the using of steam and superheated steam for the purpose of separating and removing the more volatile from the less volatile portions of petroleum, kerosene, benzine, naphtha, and turpentine while these fluids are in a state of spray or drops.

67,988—August 20, 1867. E. G. KELLEY. *Improved petroleum still.*

Claims providing a still for petroleum or other hydrocarbon liquids with two pipes for carrying off and separating the products of distillation.

72,125—December 10, 1867. HERBERT W. C. TWEDDLE. *Improvement in apparatus for distilling oils.*

Claims a trough or troughs having perforations for the passage of the oil in small quantities, and furnished with points near to such perforations, so as to cause the oil to pass therefrom in drops or fine streams, or thin films or layers, over heated pipes or tubes placed thereunder, when used within a vacuum still.

72,126—December 10, 1867. HERBERT W. C. TWEDDLE. *Improvement in distilling hydrocarbon oils.*

Claims securing a continuous and complete distillation of hydrocarbon oils, by causing the oil to flow over the surfaces of a succession of heated pipes in different vacuum stills, the temperature of such pipes increasing in each successive still, so as to drive off at first more volatile ingredients and then those less so, and so on till only the residuum remains.

84,195—November 17, 1868. EDWARD G. KELLEY. *Improved petroleum still.*

This invention consists in the application of an adjustable gate between two vessels for the purpose of regulating the gravity of the products of distillation, and the application of a self-recording gauge, which will indicate the height of the liquid in the main still.

85,810—January 12, 1869. S. GIBBONS. *Still for refining and distilling oil.*

Claims applying the steam, for vaporizing, over or above the body of the oil so as to heat it without agitation and prevent carrying over the unvaporized particles of oil.

91,477—June 15, 1869. JAMES J. JOHNSTON. *Improved apparatus for distilling hydrocarbons.*

Claims separating the lighter part of hydrocarbon oil from the heavy part, by causing it to flow through a series of layers of charcoal placed on a series of inclined ways, arranged in a chamber, provided with suitable means for drawing off the heavy part of the hydrocarbon oil.

93,952—August 24, 1869. H. J. BERG. *Improved apparatus for removing benzine from hydrocarbons.*

Claims the method for removing the benzine and other volatile matters from crude petroleum, by causing the crude oil to flow gradually in a thin stream over a heated plate, whereby the volatile principles will all be evaporated with great certainty and rapidity.

103,385—May 24, 1870. HENRY A. STEARNS. *Improvement in apparatus for distilling hydrocarbons.*

Claims the improved distillery apparatus consisting of a chamber with suitable inlets and outlets, and provided with a series of alternating hollow flat surfaced evaporators, the interiors of which are connected and so arranged that a current of steam may be forced from one to the other throughout the series.

190,483—May 8, 1877. HERMAN FRASCH. *Improvement in apparatus and processes for the separation and treatment of oils.*

Claims the process for the separation and treatment of oils, consisting of causing them to pass in thin films over heated pipes or other surfaces in contact with an air draft in an air flue, and passing the said draft and separated light oils afterwards through suitable condensers and receivers.

205,792—July 9, 1878. HERMAN FRASCH. *Improvement in apparatus for distillation of oils.*

Claims in an apparatus for separating from oil its more volatile ingredients and for collecting the different products, a vaporizer, feeding mechanism for delivering the liquid to be treated in drops, films, spray, or other disseminated form upon the vaporizer, said vaporizer being disconnected from any condensing surface that would direct any product of condensation back into the liquid that has passed over the vaporizer, and in connection therewith a condenser substantially parallel with and in such close proximity to the vaporizer that the vapors set free will be condensed as soon as they are given off, said condenser and vaporizer provided with separate conduits to gather the respective products.

498,518—May 30, 1893. ROBERT H. LAIRD. *Apparatus for vaporizing oil.*

Claims in an apparatus for vaporizing oil the combination of an outer shell, a series of metallic distributing plates within said outer shell, each of said distributing plates having its upper surface downwardly inclined from the middle to a point near the periphery and upwardly inclined from said point to its periphery, means for supplying oil to said apparatus, means for supplying heat to the said distributing plates and means for conducting away the vapors as they are generated.

Subclass 9.—Furnaces and Flues.

25,552—September 20, 1859. MORRIS L. KEEN. *Improved mode of distilling liquids from coal tar.*

Claims the application of additional heat at or near the surface of the coal tar or other similar hydrocarbon, when used in combination with pressure in the boiler, for the purpose of preventing the tarry foam from rising and overrunning the still, and thus endangering the operator as well as the premises.

33,905—December 10, 1861. G. T. SAWYER, W. HOWLAND, JR., AND T. C. HATCH. *Improvement in setting stills.*

The object of this invention is to obtain a uniform heat under all parts of the bottom of a still, retort, or kettle; and the invention consists in the arrangement near the outer edge of the bottom of the still, retort, or kettle of a series of diving flues communicating with a flue which runs all round the setting at, below, or near the level of the lower part of the fire chamber and connects with the main flue or chimney.

34,816—April 1, 1862. S. G. CLARK. *Improvement in stills for coal oils.*

Claims the combination of a steam retort with a fire heat retort, arranged and operating as and for the purpose specified.

45,363—December 6, 1864. HERBERT W. C. TWEDDLE. *Improved mode of utilizing the waste gas from petroleum distilleries.*

Claims the mode of heating the furnace of stills for distilling petroleum or carbon oil by means of the permanent gas evolved from the petroleum in the stills during the process of distillation.

48,265—June 20, 1865. A. DUBREUIL. *Improved apparatus for distilling petroleum.*

Claims the use of boiling water inside the retort or still to vaporize the material known as "petroleum" or "rock oil."

48,896—July 25, 1865. JOHN BIBBY AND ALLEN LAPHAM. *Improvement in stills for distilling petroleum.*

Claims an elevated exit chamber in combination with a chimney or flue which passes through the center of the still.

49,740—September 5, 1865. LEVI S. FALES. *Improved method of setting stills.*

Claims the combination under one retort of two furnaces, two parallel partition walls which partly support the bottom of the retort, and a central or intermediate return flue, common to both furnaces and forming their communication with the chimney, the whole constructed and arranged within the inclosing walls of the still.

57,311—August 21, 1866. JAS. B. GRANT. *Improved apparatus for distilling oil.*

Claims the employment, in apparatus or machinery for distilling and refining petroleum and other oils, of a series of heating pipes set in the form of two cones, the bases of which meet and through which the products of combustion from the furnace pass.

58,197—September 25, 1866. SAMUEL ANDREWS. *Improvement in distilling oil.*

Claims a fire chamber and a reverberatory chamber, in combination with throat C' and an opening 1, in the manner and for the purpose substantially as set forth.

59,317—October 30, 1866. ALLEN LAPHAM. *Improvement in stills for petroleum.*

The nature of said invention consists in an arrangement of flues, dampers, and tubes whereby heat is applied only to those portions of the still that are below the level of the petroleum therein, so that neither the still nor the products of distillation are injuriously affected, and the heat from the fire is turned off from the upper flues as the level of the liquid descends.

61,098—January 8, 1867. LYMAN PRAY. *Improved distilling apparatus.*

Claims the arrangement of one or more shelves in the fire chamber of a still to operate in combination with the still, flues, and dampers.

62,750—March 12, 1867. JOHN HUNTINGTON. *Improvement in the construction of stills for oil.*

Claims two flues and a damper or their equivalents arranged in relation to an annular flue surrounding the base of the still, and operating conjointly in such a manner as to be combined with a single or double furnace to diffuse a uniform heat without injury to the oil or burning of the still, and also to induce a current of cold air to reduce the heated oil and still.

99,081—January 25, 1870. JOHN GRACIE. *Improvement in stills for hydrocarbons and other substances.*

Claims a main still or evaporator, in combination with one or more separate communicating heaters, the latter being arranged so as to be acted on externally by the heat, and the former being protected therefrom.

112,751—March 14, 1871. WILLIAM GRAY WARDEN. *Improvement in apparatus for distilling petroleum and other liquids.*

Claims a still or boiler, consisting of a vessel, having an internal flue closed at the top, so as to have a downward draught, in combination with a continuous annular flue surrounding the vessel and communicating with the fireplace, and through tubes with the said internal flue.

114,803—May 16, 1871. JOHN GRACIE. *Improvement in stills for oil.*

Claims in counter distinction to a vertical still for hydrocarbon oil, a horizontal still, the bottom of which is free from the direct application of distilling or decomposing heat, combined with a flue or flues, and condensing apparatus.

117,405—July 25, 1871. JOHN GRACIE. *Improvements in stills for oil.*

Claims a still provided with a series of horizontal return flues, communicating with fire chambers and a smoke flue or flues.

117,406—July 25, 1871. JOHN GRACIE. *Improvement in stills for oil.*

Claims a still, constructed with a series of flues arranged horizontally, or nearly so, a little above the bottom, and converging to a common center, so that its bottom shall be free from the direct application of a distilling or decomposing heat.

126,503—May 7, 1872. SAMUEL VAN SYCKEL. *Improvement in relieving oil stills of gas, etc.*

Claims relieving an oil still of its gas and inflammable products by means of a current or currents of steam acting upon the gas for the twofold purpose of drawing the gas from the reservoir and forcing it into the furnace with the steam, to be burned and utilized.

152,440—June 23, 1874. SAMUEL VAN SYCKEL. *Improvement in the distillation of hydrocarbon oils.*

Claims a still, provided with a series of pipes, extending downward from the bottom plate into the fire box, and opening into a common refuse pipe at a point below the fire level.

158,042—December 22, 1874. CHRISTOPHER CUNNINGHAM. *Improvement in the manufacture of oil stills.*

Claims the combination, with a still chamber, of a vertical pipe passing through the oil chamber, and connected at its lower end with the bottom, and provided at its upper end with a horizontal or cross flue, open at both ends and communicating with the surrounding flue for bracing the bottom of the still, and providing an enlarged heating surface.

191,203—May 22, 1877. SAMUEL VAN SYCKEL. *Improvement in continuous distillation and apparatus therefor.*

Claims the process herein described for distilling hydrocarbon oils, which consists in heating the contents of the still uniformly throughout, and delivering the oil to be distilled into the chamber near the surface of the contained oil, after the incoming oil has acquired the temperature of the body of oil in the still, whereby the body of the oil in the still remains undisturbed, and the distillation may be conducted at low temperatures, and in a system of stills arranged for continuous distillation, the combination of two or more stills having heating flues which surround and traverse the stills, the stills being connected by oil-supply pipes which pass through their lower parts and deliver the vapor into the vapor spaces and the oil below the surface of the oil of the respective stills.

191,204—May 22, 1877. SAMUEL VAN SYCKEL. *Improvement in oil stills.*

Claims in combination with an oil or similar still, having surrounding and traversing flues which extend to the height of the oil within the still, a supply pipe which rises within the still from a point at or near the bottom of the still and delivers just below the liquid level, and having branch pipes for the escape of the vapor.

205,407—June 25, 1878. GEORGE MILES. *Improvement in oil stills.*

Claims a horizontal still, combined with fireplaces and flues, and having its bottom semielliptical in transverse section, its ends concavo-convex, and its crown curved transversely and sloped from its ends upward to its middle.

212,084—February 4, 1879. CHARLES M. GEARING. *Improvement in stills for hydrocarbon oils.*

Claims the combination of an upright still with inlet and outlet pipes, an exterior casing a furnace with a V-shaped deflector, and a dome with damper.

214,199—April 8, 1879. WATSON RYDER. *Improvement in apparatus for the continuous distillation of hydrocarbon oils.*

This invention consists in a furnace having a curved arch-shaped roof, so located as to project up above the level of the bottom of the sides of the still, in combination with a grate placed at or near the level of the bottom of the sides, whereby the desired pockets are formed for the collection of the deposits without accumulating at points immediately over the fire, the form of the roof of the furnace being such as to afford the greatest strength for resisting the pressure from above and best adapted to allow the heat to be absorbed by the contents of the still, which, in connection with the location of the grate and of cold-air flues of peculiar construction, prevent the top and curved sides of the fire chamber from being burned, warped, or otherwise injured, the low position of the grate admitting of a large area for the fire chamber, and being at a convenient height to supply fuel thereto—a feature of importance in this class of stills, where they are necessarily elevated, in order to locate the tar condenser or drawing off apparatus below the still.

214,946—April 29, 1879. HENRY E. PARSON. *Improvement in apparatus for utilizing waste gases of distillation in refining petroleum.*

Claims the combination of an oil pipe connecting the condensing coil and receiving tank, and of an injector of a petroleum still, the oil pipe having one or two gas chambers or receivers, with a gas returning pipe and with a gas escape pipe, storing and distributing tube, and exit pipe opening into the atmosphere.

219,546—September 9, 1879. ELIJAH WESTON. *Improvement in oil stills.*

Claims a still for volatilizing oils by heat, provided with internal partition plates adjacent to the heating surfaces, and forming open passages for a free circulation, whereby the oil is brought in direct contact with the heating surfaces in separated quantities.

240,914—May 3, 1881. HIRAM E. LUTZ. *Petroleum still.*

Claims in an oil still for continuous distillation of petroleum one or more pockets or auxiliary receptacles to collect the separated tar from every part of the still and feed it to one or more points forming part of said pockets, said receptacles or pockets being wide and circular or curved at the top, where they open into the annular space of the still. and being pointed, or nearly pointed, at the bottom.

251,770—January 3, 1882. JOHN B. DUBLER. *Oil still and attachment.*

This invention consists of a still, of any suitable shape or size, provided with an adjustable fire check, so that the heat from the fires will always be upon the bottom of the still and at the same time be on a line with the top of the oil in the still.

269,382—December 19, 1882. ASA A. BUSH. *Still for refining petroleum.*

Claims a still for refining petroleum, consisting of the body, provided with an annular depressed ring, said depression being provided with two or more sets of direct and return flues.

298,825—May 20, 1884. ROLLIN C. CLARK AND MURRAY H. WARREN. *Petroleum still.*

Claims in a petroleum still, the combination, with a heating chamber, the lower portion of which is divided into two parts by a bridge wall, a flue communicating with one portion of said chamber, and a flue or opening in the bottom of the other portion of said chamber, of a vertical still supported on standards directly over the last mentioned opening and provided with vertical flues.

739,757—September 22, 1903. WATSON RYDER AND JOHN A. QUALEY *Still for petroleum oil or hydrocarbon fluids.*

Claims in a petroleum still, a furnace and a retort, the latter having a flue therein for the products of combustion, the same being connected with the crown sheet of the retort, which crown sheet is adapted to yield with the expansion of said flue without becoming disconnected therefrom or fracturing said flue, and air ducts at the base of said retort connecting with spaces at the rear of the retort between its rear crown sheet and the adjacent end of the furnace.

Subclass 10.—Heads.

12,852—May 15, 1855. FRANCIS BOWMAN. *Improvement in rosin stills.*

Claims the arrangement of a still by inserting a metallic tube and section of a tube, covered with glass inside and outside, or a similar tube, not covered with glass, projecting at any distance from the inside toward the center of the upper section of the still; also the suspension of the inverted bowl covered with glass inside and outside.

20,562—June 15, 1858. JOHN HOWARTH. *Improvement in apparatus for distilling oils.*

Claims in combination with a still, a reservoir, placed above the level at which the oil is to be kept in the still, and a worm, heated as described or in any other manner, whereby heated oil under pressure is fed into the still in such a manner as to keep the oil therein always at one and the same level.

52,151—January 23, 1866. LEVI S. FALES. *Improved apparatus for the distillation of tar and other substances.*

Claims in connection with a cooling chamber at or near the outlet of a retort, between it and the ordinary condenser, for the separation of the heavier from the lighter vapors eliminated in the distillation of tar and heavy oils and substances, the employment of means of regulating the supply or action of the cooling medium, whereby a uniform density of light oil is obtained.

59,334—October 30, 1866. JOHN F. COLLINS. *Improved apparatus for distilling petroleum, etc.*

Claims so constructing the mouth of a still, and combining it with a goose neck or exit pipe, as to provide for the admission of air around the mouth specified.

335,281—February 2, 1886. HENRY GOLDWATER. *Apparatus for vaporizing liquids.*

Claims in combination with a still, casings and means for arresting the current of vapor and projecting it with its contents downward, pipes leading from the casing above the retort, and communicating with the upper portion of the chamber.

340,499—April 20, 1886. HERMAN FRASCH. *Process of and apparatus for distilling hydrocarbon oil.*

Claims an oil still having in immediate proximity to the still and in free communication therewith a dome of the proportions and filled with irregular blocks or pieces of about the size stated, and having also the vapor escape pipe leading from said dome, so that the hydrocarbon vapors in leaving the still pass by tortuous paths without appreciable resistance through material of practically the temperature of the boiling oil. and deposit thereon any particles of liquid held in suspension without being themselves condensed to a material extent.

353,362—November 30, 1886. GEORGE H. KLINE. *Process of distilling petroleum.*

Claims in the process of distilling crude petroleum, passing the light vapors of the petroleum through a thin layer of divided material located upon a perforated diaphragm above the surface of the liquid and within the body of the still, and which material is at a lower degree of temperature than the vapors and does not substantially act chemically upon the vapors, whereby the heavier vapors are obstructed and caused to return for redistillation.

366,487—July 12, 1887. J. MORITZ KRIESER. *Process of and apparatus for distilling petroleum.*

Claims in the process of distilling petroleum, the improvement consisting in passing a current of a cooling medium through the still near the bottom thereof without coming into immediate contact with the oil, whereby the tarry matters and heavy oils are kept at the bottom of the still.

366,720—July 19, 1887. HENRY GOLDWATER. *Apparatus for refining illuminating and lubricating oils.*

Claims in a distilling apparatus, the combination of a main retort with subretorts, a suitable furnace for heating the same, a chamber seated thereon, a pipe connecting the bottom of the chamber with the subretort, and pipes for leading off the vapors from the retort and subretort.

384,768—June 19, 1888. J. MORITZ KRIESER. *Apparatus for vaporizing liquids.*

Claims in a petroleum-distilling apparatus, the combination of the still, the dome or discharge pipe, the shallow chamber above the still, the vapor chamber above the shallow chamber, the pipes leading from the shallow chamber to the top of the vapor chamber, means, such as an arresting cap and return pipes for arresting and returning the principal portion of the heavy vapors and unevaporated liquid, the series of vessels having concave tops and level rims, forming basins or traps, arranged one above the other, so that water overflowing the top basin will trickle down the sides of the vessel and the intervening pipe to the next beneath, a pipe for flowing cold water on to the upper trap, and a pipe for carrying it away from the lower one.

432,525—July 22, 1890. HENRY GOLDWATER. *Apparatus for purifying vapors.*

Claims in an apparatus for purifying vapors, a retort and suitable passages, in combination with a casing and a series of removable pans arranged so that a portion of an annular passage is provided between such series and the casing, and with a perforated floor and movable perforated plate.

443,328—December 23, 1890. THOMSON McGOWAN. *Apparatus for distilling hydrocarbons.*

Claims in a distilling apparatus, the combination, with a still and a trough on the inside wall or walls of the still, of a diaphragm located between the trough and the dome of the still, pipes in said diaphragm for the upward passage of vapor, and a discharge opening or pipe leading from the trough outside of the still for conducting off the products of distillation.

454,061—June 16, 1891. THOMSON McGOWAN. *Apparatus for distilling.*

Claims the combination, with a still and a diaphragm for dividing the still into two compartments, of a cylinder or container located over an opening in the diaphragm and supported by the latter, said cylinder or container having one or more screens supported thereby, and having a perforated hood with bent tubes.

553,206—January 14, 1896. DAVID CANTOR. *Distilling apparatus.*

Claims in a distilling apparatus, the combination of a boiler with an upright pipe leading therefrom, a pan supported thereon, a cover therefor carrying a condensing sheet and having an upright pipe, a plurality of similar pans and covers connected in like manner, and a system of drain pipes leading from the bottom of each pan to the still.

Subclass 11.—Apparatus—Stills and Jackets.

3,067—May 2, 1843. JOHN THURSBY. *Improvement in tarring yarn.*

Claims the compound or admixture of tallow or other oleaginous substances with turpentine, oil of tar, gum elastic, spirits of turpentine, and tar.

7,124—February 26, 1850. ANTHONY M. POISAT AND DAVID C. KNAB. *Improvement in distilling oleaginous matter.*

Claims facilitating and improving the distillation of fatty and oleaginous substances by the introduction of steam at or near the bottom of the boiler containing such substance, in combination with the application of external heat.

11,059—June 13, 1854. SAMUEL CHILDS. *Improvement in stills for distilling fatty bodies.*

Claims the use of a stratum of steam within a jacket or case between a fire heat and a vessel containing any article under treatment, whereby the heat applied to said vessel can be any desired amount, and the same can be regulated to any desired point, according to the supply and delivery of the steam.

20,465—June 1, 1858. LEONARD BELLINGRATH, JR. *Apparatus for distilling turpentine.*

Claims the arrangement of the inclosed air space between the alembic and outer jacket or case, when said air space is furnished with air passages, and an indicator of heat, so that the inclosed air may be heated by conduction instead of by the direct application of the fire.

32,951—July 30, 1861. JOSHUA MERRILL. *Improvement in casings of stills.*

Claims incasing a still so as to surround the sides of the still with a confined air space or chamber.

40,168—October 6, 1863. CHARLES A. HARDY. *Improvement in oil stills.*

Claims the use of a cylindrical still (for distilling coal oil without the direct application of a furnace), such still having an inner or false bottom, forming a hot-air or steam space on the under side of the still.

41,871—March 8, 1864. ALEXIS THIRAULT. *Improvement in distilling rock oil.*

Claims subjecting petroleum or rock oil to repeated evaporations by condensing the vaporous products in one and returning the condensed liquid to the still through another pipe.

46,089—January 31, 1865. GEO. H. S. DUFFUS. *Improvement in retorts for distilling petroleum.*

Claims in stills for rectifying petroleum and other oils or producing illuminating or other oils or gases from any substances capable of treatment by heat, covering the still with a jacket inclosing or composed of nonconducting materials.

46,923—March 21, 1865. ADOLPH MILLOCHAU. *Improved apparatus for distilling petroleum, etc.*

Claims the distillation of heavy and light oils jointly to produce a burning oil by means of a second still within the main still for petroleum and similar oils.

53,167—March 13, 1866. ADOLPH MILLOCHAU. *Improvement in distillation of petroleum.*

Claims the method of preparing crude oil for distillation by evaporating the benzine and other volatile substances by a coil of pipe containing heated vapors and returning the condensed benzine into the crude oil.

62,362—February 26, 1867. ALONZO C. RAND. *Improvement in stills.*

Claims surrounding and enveloping a still with an adjustable covering or jacket, filled with a nonconducting substance.

66,841—July 16, 1867. C. G. HOWELL. *Improved apparatus for distilling and refining petroleum.*

Claims distilling, refining, and reducing petroleum and other liquids by the direct action of heat to the heating vessel and by the action of steam on a retort placed in a steam boiler.

77,094—April 21, 1868. CHARLES W. REQUA. *Improvement in stills for distilling hydrocarbons.*

Claims the use of steam in the distillation of liquid hydrocarbons in stills heated by external fire, when the steam is introduced into the still in such a manner that the lowest stratum of liquid therein will be continually removed from contact with the bottom of the still by the action of the steam, and its place supplied with fresh liquid from above.

97,998—December 14, 1869. JOHN WARREN. *Improvement in stills for oil, etc.*

This consists in the employment of a perforated convex arch over all of the fires, for the purpose of distributing the heated gases more evenly beneath the still bottom; in withdrawing the heated products of combustion from the circumference of the combustion chamber; in running all of the smoke flues from the chamber of combustion into one common chamber within the foundation of the still, at its center, radially, and from thence through the main flue into the chimney; in the employment of a hollow central pier, so arranged that the upper portion thereof shall contain the tar pipe, and the lower portion of said pier shall serve for the central receiving chamber of the smoke flues; in the employment of a hinged or removable jacket around the base of the goose neck; in the arrangement of the ventilating pipes within the sides of the jacket or casing, and, in combination therewith, in the arrangement of the traps or doors upon and within the upper side of said casing; and, finally, in the general construction and arrangement of the heating and ventilating devices and of the casing.

114,802—May 16, 1871. JOHN GRACIE. *Improvement in stills for hydrocarbons.*

Claims surrounding a still for hydrocarbon with an air chamber and combining therewith an air pump.

156,229—October 27, 1874. THOMSON McGOWAN. *Improvement in oil stills.*

Claims a still for distilling hydrocarbons, and other liquid similar substances, having an elongated bottom, extending through and below the fire in the furnace, and communicating with a receiver or pit, for collecting the tar and residuum.

225,635—March 16, 1880. PIERRE NICOLAI. *Apparatus for distilling oil.*

Claims a receiver provided with a double casing and a double-cased projection communicating with each other, in combination with a steam coil, in communication with the casing of the said projection.

231,280—August 17, 1880. GERARD CRANE. *Oil still.*

This invention consists in a novel arrangement of a small still within a larger or main still and another small still outside of said main still, and a novel combination and arrangement of devices employed in connection therewith, whereby the process of distilling the oil is facilitated and hastened by enabling the oil to give off the more volatile products of distillation at the same time that the heavier products are being given off, and by means of the same fire for all of said stills.

231,420—August 24, 1880. HERMAN FRASCH. *Apparatus for fractionally condensing oil vapor.*

Claims in an apparatus for fractionally separating oils from vapors of the same, the combination, with a condenser, of a bath capable of sustaining a constant temperature above 212° Fahrenheit, and a duct for drawing off and separately collecting the product condensed by the temperature of said bath.

275,589—April 10, 1883. ROLLIN C. CLARK AND WILLIAM F. BEECHER. *Process of distilling petroleum*

Claims the combination, with a still located in a closed chamber and completely surrounded by air, of means to heat the air of said chamber.

314,490—March 24, 1885. JOSHUA THOMAS. *Apparatus for refining oils.*

Claims a stationary oil still surrounded by a hollow steam jacket, in combination with a steam heating coil in the lower part of said still, but discharging externally thereto, said still being closely incased in masonry.

318,698—May 26, 1885. ROLLIN C. CLARK AND MURRAY H. WARREN. *Still and filter.*

Claims in an oil still, the combination, with a heating chamber and a still located therein, of a heat generator located within an air chamber and communicating directly with said heating chamber, a hot-air flue leading from said air chamber, and a chimney in open relation with the heating chamber.

339,546—April 6, 1886. JAMES B. GRANT AND ALLAN MASON. *Apparatus for refining oil.*

Claims in an apparatus for refining oils, the combination, with a retort, and a connected condenser and vacuum pump, of an oil pipe having its exit end arranged within the retort, and an acid reservoir having an acid pipe similarly arranged, and having its exit closely adjacent to that of the oil pipe, whereby the stream from either pipe is impinged directly upon that of the other.

546,018—September 10, 1895. KARL LÖFHJELM. *Apparatus for distilling tar and refining turpentine.*

Claims the combination of tar still, turpentine still consisting of a jacketed turpentine holding tank, tar receiver connected with the tar still by a pipe descending from the tar still thereto, and condenser for the wood gases, said tar still and tar receiver connected with the jacket of the turpentine still for conducting the wood gases thereto, and said condenser connected with said jacket of the turpentine still for receiving the gases therefrom.

Subclass 12.—Rotary.

24,921—August 2, 1859. WILLIAM T. BARNES. *Improvement in apparatus for generating coal oil.*

Claims the arrangement of levers and rod, whether operated by a cam or otherwise, for the purpose of forming an automatic dust clearer to coal oil retorts.

27,327—February 28, 1860 FRANKLIN W. WILLARD. *Improvement in apparatus for distilling coal oil.*

Claims the arrangement of a series of valves and ports, in combination with a revolving retort, so operating as to always leave open one or more of the said ports at the upper portion of the retort and keep the remaining ports at the lower portion thereof closed.

27,503—March 13, 1860. FRANKLIN W. WILLARD. *Improvement in apparatus for distilling.*

Claims the method of distilling and evaporating liquids, consisting in the employment of a revolving still provided within its interior with a series of buckets, whereby while the still is maintained at a uniform temperature the liquid which is to be acted upon is kept in motion, and portions of the same successively separated, taken up, and returned to the mass in thin films.

37,798—March 3, 1863. J. L. ALBERGER. *Improvement in apparatus for distilling coal oils.*

Claims the employment simultaneously within an oil distilling retort of a steam supplying and a steam heating system of pipes.

48,672—July 11, 1865. CARLOS F. FREDERICI. *Improved apparatus for distilling.*

Claims a distilling apparatus composed of a series of hollow drums (two or more) connected by oblique pipes and provided with gudgeons on which it revolves.

91,448—June 15, 1869. JAMES J JOHNSTON. *Improved apparatus for distilling hydrocarbon oils.*

Claims distilling hydrocarbon oil by distributing it, through the medium of a pipe, in small jets or streams, against the inner surface of a revolving still, in which is placed a revolving shaft, armed with a spiral flange, so arranged that it will force the vapor evolved from the hydrocarbon from the still into the condenser.

148,806—March 24, 1874. WILLIAM J. BRUNDRED. *Improvement in oil stills.*

Claims a double revolving still, with steam chamber in combination with stationary steam pipes.

552,455—December 31, 1895. EDUARD THEISEN. *Apparatus for evaporating or distilling liquids.*

Claims in apparatus for evaporating or distilling, the combination with a drum and means for supplying material to the interior thereof at one point, of a mechanical scoop entering the drum and withdrawing the residual liquid therefrom at a point removed from the point of supply, means for revolving the said drum at a speed sufficient to cause, by centrifugal force, the material to travel over its interior surface in a thin film, from the point of delivery to the point of discharge, and an external means of heat impinging upon the surface of the drum.

552,456—December 31, 1895. EDUARD THEISEN. *Apparatus for evaporating or distilling liquids.*

Claims in apparatus for evaporating or distilling liquids the combination of two or more concentric revolving drums, means for heating the outer surface of the outer drum, means for supplying liquid to the inner surfaces of all the drums so as to travel in a thin layer over the said surfaces in order to be evaporated by the heat transmitted through them, means for removing the residual liquid from one or more of said drums after it has passed over the surfaces of said drums, and means for withdrawing the portion of the liquid separated by evaporation when condensed.

619,593—February 14, 1899. FREDERICK WILLIAM MANN. *Apparatus for distilling petroleum.*

Claims a petroleum distilling apparatus, comprising a closed vessel having a portion thereof adapted to be heated, a partition within the vessel lying close to such heated surface, means for introducing a petroleum spray into the space between said partition and the heated surface of the vessel, and means for maintaining a uniform pressure in said vessel.

Subclass 13.—Series.

27,842—April 10, 1860. D. S. STOMBS AND JULIUS BRACE. *Improvement in distillation of coal oil.*

Claims the apparatus consists of three retorts heated independently of each other, in order to be heated respectively to various degrees of temperature. Tubes extending down near to the bottom of the retorts in which they are respectively arranged, are closed at the bottom but open at the top, and serve as thermometers, by means of which the temperature in each of the retorts is indicated. The first retort is furnished with a pipe leading into the upper part through which the crude oil is to be supplied to the apparatus. At the opposite end and lowest part of the said retort is connected a pipe, the other end of which is connected to the next retort, at a point somewhat above its middle line. In like manner from the opposite lower extremity of this retort a pipe leads to the third retort. The last retort is provided with a similarly arranged pipe, leading from the bottom of said retort.

53,062—March 6, 1866. PETER H. VAN DER WEYDE, M. D. *Improvement in stills for petroleum.*

Claims the combination of three, four, or more stills, in single furnace in order to obtain with a single fire, and one single operation all the different volatile products of the petroleum—namely, lubricating oil, kerosene, benzine, naphtha, or gasoline.

53,359—March 20, 1866. AUGUSTUS H. TAIT AND JOSEPH W. AVIS. *Improvement in distilling apparatus.*

Claims the arrangement of a series of retorts, set horizontally alongside of each other over and across the fire flue, with the breadth of the fire grate nearly equal to the length of the retorts, the furnace being placed at one and the chimney at the other end of the series.

53,359—March 20, 1866: reissue 4,366—May 2, 1871. AUGUSTUS H. TAIT AND JOSEPH W. AVIS. *Improvement in apparatus and processes of distilling petroleum and other oils.*

Claims the process of continuous distillation consisting in causing the oil to flow through a series of retorts arranged over an arch or flue, so that the oil enters at the coldest portion of the series and leaves at the hottest portion.

58,512—October 2, 1866. PETER H. VAN DER WEYDE. *Improved double still for petroleum.*

The smaller still is placed outside of the first on the flue, thus economizing heat, and giving the second still a sufficient amount, but always a little less than that received by the first still. It is placed so much higher than the first that its bottom is equal with the surface of the oil in the first still when filled, connecting them with tube and stopcocks.

The condensers are placed as low as practicable—the bottom of the first condenser being only about four inches above the surface the oil has to reach in the second still, and the bottom of the second condenser about four inches above the level of the surface of the oil in the first still when filled.

A short, wide goose neck with dome attached, well protected for cooling influences by a felt covering, and connected by means of a slightly descending tube with the condensing worm, is employed.

63,115—March 19, 1867. A. H. TAIT AND JOSEPH W. AVIS. *Improvement in apparatus for distilling petroleum, etc.*

Claims a double still in which all the defects and objections against other double stills are corrected in the manner described.

This invention relates to a distilling apparatus which consists mainly of a still divided by one or more partitions into two or more compartments, which communicate with each other at the top by suitable openings for the vapors and at the bottom by openings for the liquid. The opening or openings in the top are provided with gates or cocks to shut off the communication and divide the light from the heavy vapors, so as to pass each into its appropriate condenser. The crude oil is admitted to that compartment farthest from the fire, and the compartment or compartments next to the fire are provided with valves or gates, so that the communication between the same and the preceding compartment or compartments can be cut off, and the compartment or compartments over the fire can be cleaned without being compelled to empty the entire still. The first and last compartments of the still are connected by a pipe which serves to equalize the gravity of the liquid contained in said compartments whenever it may be desired. The last compartment of the still connects with the coking retorts, in which the refuse or heaviest parts of the oil are subjected to a final distillation.

71,156—November 19, 1867. ANDRE FOUBERT. *Improvement in apparatus for distilling.*

The nature of my said invention consists in such an arrangement of pipes and cocks, applied in connection with two stills, that the vapor and water of condensation that pass off from one shall be utilized and employed in warming up the mash or wine in the other still, previous to commencing the distilling operation, thereby effecting a saving both of time and heat, as the fresh charge, supplied alternately to the stills, is brought to nearly a boiling point by steam that has heretofore been wasted.

78,878—June 16, 1868. ARTHUR KIRK. *Improvement in distilling petroleum.*

Claims effecting a continuous distillation of petroleum, or other distillable substances, by causing it or them to flow through a succession of stills, giving off in each still the more volatile ingredients, the stills being connected by trap pipes so as to prevent the backward flow of the substance to be distilled.

101,364—March 29, 1870. SAMUEL A. HILL AND CHARLES F. THUMM. *Improvement in stills for hydrocarbons.*

Claims a series of stills connected together by pipes which connect with zigzag ways or channels made in or on the bottom of each still, each still of the series being provided with a goose neck and condenser.

101,365—March 29, 1870. SAMUEL A. HILL AND CHARLES F. THUMM. *Improvement in stills for hydrocarbons.*

Claims a still divided into a series of compartments, the bottom of each compartment being provided with zigzag ways or channels, the compartments communicating with each other, and provided with a goose neck and condenser.

102,819—May 10, 1870. SAMUEL A. HILL AND CHARLES F. THUMM. *Improvement in apparatus for distilling hydrocarbon oils.*

Claims the combination and arrangement of a series of stills, so arranged with relation to each other that the flow of hydrocarbon through one or more of the stills of the series may be cut off from the other stills of the same series, and each still of the series being furnished with separate fire chamber, so as to apply a different degree of heat to each still.

135,673—February 11, 1873. AUGUSTUS H. TAIT AND JOSEPH W. AVIS. *Improvement in stills for petroleum and other liquids.*

Claims the arrangement in a still of partitions made in sections, the lower sections being made movable by means of hinge joints or slides, or otherwise.

136,008—February 18, 1873. EMIL SCHALK. *Improvement in oil stills.*

Claims a still for securing the distilled products of petroleum, consisting of a retort having a large passage from side to side, a lower chamber, an upper chamber, vertical chambers, and vertical tubes, all arranged as set forth.

136,008—February 18, 1873; reissue 5,988—July 28, 1874. EMIL SCHALK. *Improvement in oil stills.*

Claims the combination with an oil still having oil inlet at the bottom and gas outlet at the top of a heating chamber, placed between the top and bottom of still and having spaces around the same.

154,772—September 8, 1874. SAMUEL VAN SYCKEL. *Improvement in apparatus for distilling hydrocarbon oils.*

Claims in combination with a primary still or stills and the final still or stills, intermediate still or stills, having transfer and vapor connections for the purpose of equalizing the temperature of the liquid between the primary and final stills.

172,131—January 11, 1876. EDWARD LANE. *Improvement in oil distilling processes and apparatus.*

Claims the continuous process for fractionally distilling or refining crude petroleum by direct heat, consisting in the following successive steps: First, heating the crude oil and at once withdrawing the free water; second, distilling off the lighter oils, and at the same time withdrawing further water; and, third, subjecting the remaining oil to successive heatings alternated with evaporations and condensations at successively high temperatures, wherein the oil is prepared by heat for each evaporation.

182,169—September 12, 1876. JAMES COLE, JR. *Improvement in apparatus for the separation of petroleum products.*

Claims the combination, with a still provided with a vapor outlet, of perforated steam pipes for applying heat to the contained liquid, and an independent blast pipe for introducing within the still a current of air or steam.

220,962—October 28, 1879. JAMES COLE, JR. *Improvement in apparatus for distilling petroleum.*

Claims the combination, with a primary still, primary condenser, secondary still, and pipe which passes through said condenser and opens into the secondary still, of an independent pipe, connecting the secondary still with the primary still.

314,368—March 24, 1885. RICHARD DEAN. *Apparatus for the distillation of hydrocarbons.*

Claims a still for distilling hydrocarbon oils, and provided with a crown sheet, and inner and outer plates extending below the body of the still, forming hollow so-called legs that extend the length of the still, and one or more fire boxes located between the legs and under the crown sheet, one or more feed pipes leading into the leg on one side, and a discharge pipe connected with the opposite leg, and the parts so arranged that a continuous flow of oil is had through the still and maintained at a uniform depth by the elevation of the discharge pipe.

340,878—April 27, 1886. NORMAN M. HENDERSON. *Apparatus for distilling or refining mineral oils.*

Claims the combination of a still and its inlet and outlet pipes, having the usual stopcocks outside the still, with weighted valves applied to the said pipes within the still, and having handles extending to the outside.

342,500—May 25, 1886. RICHARD DEAN. *Apparatus for distilling hydrocarbon oils.*

Claims for the fractional distillation of hydrocarbon oils, a series of stills forming a plant, each of said stills consisting of a steam-tight cylinder having therein an oil-eduction pipe and induction oil tubes, the lower ends of which tubes terminate in an oil chamber in the lower end of the next succeeding cylinder, and the upper ends of the tubes and the upper end of said oil-eduction pipe terminating in a vapor chamber in the upper part of the cylinder, said chamber being in communication with a deodorizing chamber provided with a vapor-discharging pipe, oil-feed pipe terminating in the lower chamber of the cylinder, with a steam pipe arranged to induct steam into said cylinder, and a pipe for exhausting steam therefrom.

374,838—December 13, 1887. EDWARD KELLS. *Distilling apparatus.*

Claims in a distilling apparatus, the combination, with primary and secondary stills, of a system of connected pipes consisting, essentially, of an escape pipe leading from the primary still through a separator, substantially as indicated, a pipe leading to the secondary still for the passage of heavier distillates, and a pipe connected to the escape pipe for the discharge of lighter distillates, the latter being carried to a considerable elevation above the said return pipe.

444,203—January 6, 1891. ALLAN MASON. *Apparatus for distilling oil.*

Claims the combination, in a still for continuous fractional distillation, of the continuous pipe retort, comprising a series of successive chambers, each having the oil inlet and a steam injector at the receiving end impinging the steam jet directly on the entering stream of oil, so as to instantly atomize it in one body and project the same along the chamber to the opposite end, and each section having a vapor exit and an oil exit thereat, through which the vapor and oil respectively escape, the one to the condenser and the other to the next section of the retort, the arrangement being such that all of both of the vapor and the unvaporized oil have like exposure as to heat and time in the respective sections of the retort, the furnace underneath said pipe retort made in separate sections, each containing a section of the retort, the flues at the opposite extremities of the chambers and the passages and dampers causing the regular or irregular traverse of the heat products through the successive sections of the furnace.

478,265—July 5, 1892. HEINRICH PROPFE. *Distilling apparatus.*

Claims in an apparatus for distilling tars and mineral oils, the combination, with a train of stills, the adjacent ones of which have intercommunication between their lower parts, of a furnace at one end of the train and a flue running therefrom to the other end of the train, a feed pipe for feeding the still at the end of the train farthest from the furnace, and an exit pipe communicating only with the still nearest the furnace and running through the several stills of the train.

524,704—August 21, 1894. ROBERT A. CHESEBROUGH. *Apparatus for continuous distillation.*

Claims a still comprising several members in communication with each other at the top, each member being provided with oil-retarding plates and the member next succeeding a previous member being provided with a depending baffle plate at its top intermediate of the inlet and outlet passages, an oil-supply pipe and a superheated steam-supply pipe in communication with the first members, means for maintaining a reduced degree of temperature in succeeding members, suitable discharge pipes leading independently from the bottoms of the several members, a condenser and a pipe leading from the final member into the condenser.

546,697—September 24, 1895. PAUL DVORKOVITZ. *Apparatus for distilling liquid hydrocarbons.*

Claims apparatus for the double distillation of liquid hydrocarbon consisting of a furnace, three superheaters located side by side within said furnace, a steam generator connected with the intermediate superheater, a crude-hydrocarbon reservoir and a tar reservoir connected respectively with the other superheaters, two retorts, provided with means for heating them, a spray pipe leading from the intermediate superheater into both retorts, a spray pipe leading from each of the other superheaters to its corresponding retort, and a separate condenser for each retort.

556,412—March 17, 1896. CHARLES F. GRADY. *Apparatus for refining petroleum.*

Claims the combination with a still, of an oil supply pipe leading thereinto and connected with perforated longitudinally disposed pipes, a steam supply pipe entering the still and extended to a point near the bottom thereof and communicating with longitudinally disposed perforated pipes, a second still, a discharge pipe disposed longitudinally within the first still and having perforations upon its under side and leading into the second still and extended above the point of steam supply in said second still, and perforated longitudinally disposed pipes and branch pipes supported by the same.

567,752—September 15, 1896. ADOLPHE SEIGLE. *Apparatus for treating hydrocarbons.*

Claims in an apparatus of the character described, a series of vaporizing chambers and a series of superheating chambers containing inert material, an inlet to the first in series of said vaporizing chambers for the reception of the hydrocarbon and an outlet from the last in the series of vaporizing chambers communicating directly with each superheating chamber, both series of vaporizing and superheating chambers being immersed in a bath of molten metal, all arranged so that the hydrocarbons are successively heated in the vaporizing chambers, and the vapor from the last in series of vaporizing chambers is conducted to each separate superheating chamber to be further heated.

728,257—May 19, 1903. MAX LIVINGSTON. *Apparatus for continuously distilling petroleum.*

Claims in an apparatus for continuously distilling petroleum the combination with a series of distinct and independent stills; of a series of pipe connections which unite said stills in a continuous series; said connections each comprising an oil outlet from one still and an oil inlet to another still; said outlet having a regulating section arranged to adjustably determine the liquid level in the still associated therewith.

731,943—June 23, 1903. WILLIAM D. PERKINS. *Apparatus for continuous fractional distillation of petroleum.*

Claims in an apparatus for continuous fractional distillation of petroleum and similar hydrocarbons, the combination of the vaporizer and a receiver for the unvaporized product, of condensers connected with said vaporizer, pipe coils or worms in the several condensers, which are connected in series, receivers for heavy unvaporized products connected with the several worms, a steam superheater and a pipe connecting it with two condenser appliances for the latter and the vaporizer, and thermostatic regulators for such heaters.

781,045—January 31, 1905. BENJAMIN F. BROOKE-SEWELL. *Apparatus for evaporating and distilling liquids.*

Claims in an apparatus for evaporating liquids the combination of two or more chambers or receptacles, means arranged in one chamber or receptacle for condensing the vapors generated therein and for transmitting heat developed during condensation to the liquid contained in the other chamber, means for collecting and carrying away the liquid formed by condensation, and means for removing solid matter deposited in the chambers or receptacles.

Subclass 14.—Tubulars.

32,568—June 18, 1861. EDWARD G. KELLEY AND AUGUSTUS H. TAIT. *Improvement in processes and apparatus for distilling, separating, and purifying petroleum.*

Claims the process for distilling hydrocarbon oils, consisting in flowing the oil in a stream through a series of retorts arranged so that the oil enters the retort in the cooler part of the furnace and is subjected to an increasing temperature as it flows, so that vapors of different densities are successively removed, and

A series of retorts or stills arranged in a furnace and connected together, so that oil may be distilled continuously by being fed into the retort or still in the colder part of the furnace, and flowing successively through the retorts in the hotter portions of the furnace, and thereby separating the different portions of oil according to the temperature at which they become vapor.

62,096—February 12, 1867; antedated January 30, 1867. P. H. VANDER WEYDE, M. D. *Improvement in tubular stills for continuous distillation.*

Claims a still, consisting of a series of tubes situated in the flue, through which tubes the liquid to be distilled is uninterruptedly passed in a small stream, and in its downward course submitted to a continual increased heat.

68,860—September 17, 1867. JOHN ELLIS AND EDWARD C. KATTELL. *Improvement in apparatus for distilling, evaporating, and refining oils and other liquids.*

Claims the construction of a retort, or a part of a retort, of a pipe or pipes, so arranged that when either steam or superheated steam and oil or other liquids are passed or forced through it, or them, in the same or in opposite directions, the fluid will naturally, from its superior gravity, repeatedly pass through the current of steam, thus thoroughly mixing it with the steam in a comparatively confined space, heating it uniformly and vaporizing it, as occurs in the tubular portion of our apparatus, and as will result if a spiral pipe is placed in a horizontal position, or approaching that position, and steam and oil passed through it.

87,207—February 23, 1869. CHARLES A. SEELY. *Improved apparatus for distilling and separating oils, fats, and the like.*

This invention consists in making the still in the form of a coil, the coil terminating at its lower end in a pipe, which moves upward, serves as a conduit of vapor to the condenser, and furnishing the coil, at its lowest point, with a tube leading downward, and serving to carry away the liquid which it is not desired to volatilize.

166,285—August 3, 1875. THOMSON McGOWAN. *Improvement in the distillation of hydrocarbon oils.*

Claims the combination, in an oil still of an elongated vessel, having a series of partitions, a steam pipe extending throughout the length of the vessel, and vapor pipes projecting from the elongated vessel.

182,775—October 3, 1876. HENRY C. ROSE. *Improvement in apparatus for distilling oil.*

This invention is an apparatus for distilling hydrocarbon oils, and it consists of a system of pipes arranged in a serpentine like manner over a furnace either longitudinally or transversely therewith. In connection with said system of pipes is arranged above them, and either parallel or transversely therewith, a system of vapor pipes, terminating in condensing coils or still worms. Said lower pipes are provided with perforated steam pipes.

215,756—May 27, 1879. JOSEPH L. KIRK. *Improvement in processes and apparatus for distilling petroleum.*

Claims in an apparatus for distilling crude petroleum, the combination of a continuous pipe through which the petroleum flows and in which it is evaporated, a series of pipes successively arranged for taking up the gases as evolved, a series of filters for purifying the gases of different density, and a series of branch pipes for mingling bleaching gases with those evolved and purified gases of petroleum, and

In the distillation of petroleum the process of clarifying and bleaching the same, which consists in vaporizing the petroleum by heat, and then passing the vapors through a filter, and subsequently mingling the vapors with the vapors of sulphuric acid or other bleaching vapors, and then condensing the petroleum vapors.

253,990—February 21, 1882. ERNEST F. DIETERICHS. *Apparatus for fractional distillation.*

Claims in an apparatus for distilling oil and other substances, the combination of a retort located in a suitable furnace and a distilling coil located in said retort with the steam supply and eduction pipes leading to and from the retort, the said pipes being connected with the retort and a suitable oil supply pipe, and provided with an injector for forcing the oil into the distilling coil.

282,239—July 31, 1883. JOSHUA THOMAS. *Oil still.*

Claims an apparatus for distilling or reducing petroleum by a continuous operation, consisting of a divided evaporating chamber, having low partitions and vapor outlets, a series of coupled pipes, arranged beneath said chamber and in an inclosed heating chamber provided with thin partitions, arranged to convey the heat alternately up and down between said pipes, a jacketed reservoir, connected by pipe to said heating chamber, and a pipe leading to chamber whereby the material to be treated is conveyed into said evaporating chamber and through the heated pipes in one direction, while the heat is conveyed in the opposite direction.

300,811—June 24, 1884. HENRY C. SMITH. *Apparatus for the continuous distillation of oil.*

Claims in an apparatus for continuous distillation of oil, pipes arranged in a plane inclined to the horizon at about an angle of forty-five degrees—one above the other—and provided with vapor outlets and connected at alternate ends with connections, and inclosed in a chamber, whereby said pipes operate for the distillation of the several gravities of oil products.

305,056—September 16, 1884. RICHARD DEAN. *Apparatus for distilling or reducing oils.*

Claims in an apparatus for distilling or reducing oils, the combination, with a series of lower stills, consisting of two or more horizontal pipes, and a series of upper stills, consisting of two or more horizontal pipes, the upper stills being connected with the lower stills by manifold branches, of oil conducting pipes connecting each upper still with the succeeding lower still, pipes connecting each upper still with a suitable vapor condenser, and steam pipes adapted to discharge free steam into each upper still.

361,671—April 26, 1887. DAVID P. BROWN AND JOHN W. NEELEY. *Apparatus for distilling.*

Claims in a retort furnace for distilling petroleum oils, adapted to supply suitable heat, the combination of a retort or series of retorts, suitably connected together, a steam pipe, entering each retort, extending through and sealed at one end, and provided with numerous small perforations, an oil pipe likewise entering each retort, extending through and sealed at one end, and provided with numerous small perforations, and another steam pipe, of like construction, extending into each oil pipe.

439,745—November 4, 1890. EVAN A. EDWARDS. *Apparatus for distilling oils.*

Claims in an apparatus for distilling oil, the combination, with a flue boiler, of a series of vaporizers arranged in the flues of the same, a steam and an oil supply pipe connecting therewith at one end, and a series of condensing traps connected therewith at the opposite end.

547,332—October 1, 1895. FRANK W. CLARK. *Distillation and breaking up of liquid hydrocarbons, and apparatus therefor.*

Claims the method or process of distilling and breaking up liquid hydrocarbons or similar substances, which method or process consists in causing the liquid to flow in numerous thin or shallow streams in one direction over the operative surfaces of an evaporator or retort, circulating a carrier such as air first in contact with heating surfaces and then over said streams of liquid in the reverse direction. and conveying the vapor therefrom by means of said carrier through a condenser and then conducting the carrier, together with any uncondensed vapor, from the condenser back into the evaporator or retort, the unvolatilized liquid in the evaporator or retort and the liquid of condensation in the condenser being drawn off as required.

567,751—September 15, 1896. ADOLPHE SEIGLE. *Apparatus for treating liquids.*

Claims in an apparatus a series of double walled sections, the interiors of which form a continuous combustion flue, the walls of the sections being separated to form a liquid chamber concentric with the flue and closed at either end of the section, a series of spiral partitions dividing the liquid chamber into a series of serpentine channels, a series of pipes each forming a means of communication between the liquid chambers of adjacent sections, and means for forcing oil through successive sections in a direction opposite to that in which the products of combustion pass through said sections.

640,292—January 2, 1900. HANS A. FRASCH. *Apparatus for continuous fractional distillation of hydrocarbons.*

Claims in a distilling column, consisting of a series of communicating shells, a manifold connected with alternate shells to receive the vapor from every two shells, and means for conducting away the separate vapors at several desired points to separate condensers, and a bottom shell having an open outlet and a vapor seal at the base of the column of shells.

737,756—September 1, 1903. WILLIAM MAYBURY. *Still.*

Claims in a still, a furnace, a continuous conduit therein formed from pipe sections, the ends of said sections extending through the walls of the furnace and provided with couplings, connectors between said couplings, and means in a portion of the couplings for creating a suction through the respective pipe sections, and for forcing the vapor or volatilized oil in said respective sections through said outlets, said means arranged to operate upon the volatilized portions only.

754,687—March 15, 1904. JAMES M. O'NEALL. *Apparatus for refining crude petroleum.*

Claims apparatus for refining crude oil comprising means for converting the volatile oil into vapor by heat, a receptacle for collecting and separating the vapor and the nonvolatile matter, a condenser for converting the vapor back to oil, and means for forcing the vapor into a fluid in the condenser.

779,398—January 3, 1905. ALBERT C. CALKINS. *Oil separator.*

Claims a separator provided with a series of pipes, a separate coupling connecting successive [series of said pipes containing a seal or trap and having independent outlet connections, jackets on each of said pipes and means for simultaneously supplying different degrees of heat within said jackets, whereby different vapors are liberated within said pipes and the remaining liquid continues its course.

Subclass 15.—Utilizing Gases and Residue.

459,123—September 8, 1891. FREDERIC LENNARD. *Apparatus for the distillation of tar.*

Claims in an apparatus for distilling tar and like substances, the combination of a furnace or heater, a tank containing a liquid bath, a still immersed or partially immersed therein, a tower or scrubber, means for conducting the material to be distilled into the upper part of the scrubber, a connection between the lower part of the scrubber and the still, a steam pipe leading into the lower part of the scrubber, and conduits which lead off the vaporous products rising into the upper part of the scrubber.

Subclass 16.—Vacuum.

34,324—February 4, 1862. HERBERT W. C. TWEDDLE. *Improved apparatus for distilling coal oil and other substances.*

Claims the use of a vacuum apparatus in combination with a steam pipe arranged in the interior of the still.

34,324—February 4, 1862; reissue 2,404—November 27, 1866. HERBERT W. C. TWEDDLE. *Improved apparatus for distilling coal oil and other substances.*

Claims the use of superheated steam, in combination with the employment of a vacuum or partial vacuum, for the distillation of petroleum and other hydrocarbon oils and similar substances.

46,633—March 7, 1865. EDWARD BRAGGINS. *Improved apparatus for distilling petroleum, etc.*

Claims a method of producing a vacuum in a condenser by water.

47,125—April 4, 1865. JAMES PERKINS AND WILLIAM H. BURNET. *Improved apparatus for refining and distilling petroleum.*

Claims the combination of two receivers with an agitator and a sediment receiver; and,

The use of two exhaust pumps in combination with a distilling and condensing apparatus described.

48,285—June 20, 1865. JAMES J. JOHNSTON. *Improved apparatus for distilling oil.*

Claims distilling oil or other liquids by means of a still, condenser, and receiving vessel, from which oil is exhausted, so that the distilling process is carried on under a partial vacuum.

50,571—October 24, 1865. HUOT FLEURY. *Improvement in distilling petroleum.*

This invention consists in the distillation of petroleum oil by a vacuum and its rectification by one single operation.

54,157—April 24, 1866. ABRAM D. HIGHAM. *Improvement in distilling petroleum.*

Claims distilling the lighter portions of the charge in vacuo and the heavier portions under pressure.

56,852—July 31, 1866. M. P. EWING. *Improvement in apparatus for distilling petroleum.*

Claims the combination of a continuous feed and a jet condenser with a vacuum still for petroleum.

58,020—September 11, 1866; reissue 7,322—September 26, 1876. Division B. VACUUM OIL COMPANY. *Improvement in material for lubricating.*

Claims the process of making residual heavy hydrocarbon oil without burning by distillation of the light oils from crude petroleum under vacuum with steam.

58,021—September 11, 1866. M. P. EWING AND H. B. EVEREST. *Improved apparatus for distilling petroleum, etc.*

This invention consists essentially in certain improvements to prevent overflowing in vacuum stills for petroleum by introducing jets of steam into and through the mass of oil in the still, and by the arrangement of the heating pipes in close proximity, so as to lessen the amount of oil in the retort as compared with the heating surface, and the employment of an overflow chamber, and conducting the overflowing material to a receptacle, thereby preventing its admixture with the distilled product; also, in the combination of a surface with a jet condenser for the oil vapor.

62,739—March 12, 1867. EDWARD DUNSCOMB. *Improvement in vacuum pumps, pans, etc.*

Claims an air induction pipe with its stopcock applied to an air-tight tank.

68,426—September 3, 1867. HIRAM B. EVEREST. *Improvement in apparatus for distilling petroleum.*

Claims the combination of two or more vacuum petroleum stills, so arranged that the oil is fed from one retort into the other as it increases in specific gravity during the distillation, and economizing the use of steam used in the vaporization of the oil in the retorts, by passing it first through the heating pipes in the retort containing the heavier oils, and afterwards conducting it through the heating pipes in the retort or retorts containing the oils of lighter specific gravity.

77,070—April 21, 1868. JAMES MILLER. *Improved apparatus for distilling petroleum.*

Claims the combination of two or more vacuum stills, one for heating the oil, and driving off its more volatile ingredients, and the other for carrying on a continuous distillation, by feeding therein the heated oil from the first still through a coiled or zigzag pipe with apertures.

89,988—May 11, 1869. HENRY GROGAN AND GEORGE T. LAPE. *Improvement in the distillation of hydrocarbon oils.*

Claims the application of cold hydrocarbon oils to a heated still, in such quantities that the heat in the still will suddenly evolve their available products, or so much of them as may be desired, before admitting a subsequent supply.

300,185—June 10, 1884. HOMER T. YARYAN. *Apparatus for vacuum distillation.*

Claims in a vacuum distillation apparatus, the combination of a coil surrounded by steam or other heating medium, a separating chamber, a vacuum pump and pipe connections.

374,077—November 29, 1887. JEAN A. MATHIEU. *Apparatus for separating substances which volatilize at different temperatures.*

Claims the combination of a vacuum pan having interior heating coils, and with atomizer devices for spraying liquid material into the vacuum pan above the trays.

Subclass 17.—Vapor Outlets.

16,255—December 16, 1856. RICHARD SHRODER. *Improvement in apparatus for coal oil.*

Claims constructing the retort or generator with openings at different heights for the purpose of obtaining oil of different qualities.

40,632—November 17, 1863. CHARLES LOCKHART AND JOHN GRACIE. *Improvement in stills for petroleum, etc.*

This invention relates, first, to a means for taking off vapor from the still at the same height from the surface of the oil and at different heights during the process of distillation; second, to a means for keeping the bottom of the still clean or free from incrustation.

40,632—November 17, 1863; reissue 3,002, June 23, 1868. CHARLES LOCKHART AND JOHN GRACIE. *Improvement in stills for petroleum, etc. Division A.*

Claims providing a still used for distilling hydrocarbon with a scraper or scrapers, combined with a receiving device, said scraper or scrapers being rotated during the process of distillation, and operating with relation to the bottom of the still and said receiving device.

40,632—November 17, 1863; reissue 3,003, June 23, 1868. CHARLES LOCKHART AND JOHN GRACIE. *Improvement in stills for petroleum, etc. Division B.*

Claims a still provided with a pipe or pipes which is or are so arranged with relation to the still and its contents that the vapor evolved from the contents of the still can be conveyed off at different heights.

105,683—July 26, 1870. JOHN HOFFERBERTH. *Improvement in oil still.*

The nature of this invention consists in providing an oil still with a short worm, for the purpose of allowing gasoline and other inflammable products of distillation to escape without combining with the refined oil; also, in connecting the long worm at a point below the top of the still, and providing a means for preventing the oil from ascending higher than such point of connection.

113,811—April 18, 1871. JOHN L. STEWART AND JOHN P. LOGAN. *Improvement in petroleum stills.*

Claims a still with its top in the form of an annular corrugation, in combination with a series of pipes so arranged as to draw off the vapor from the still at the highest part of the said corrugation.

237,560—February 8, 1881. MAX LIVINGSTON. *Oil still.*

Claims an oil still having a vapor-escape passage opening into and extending above the top of the still chamber, in combination with a succession of valve-governed vapor-escape passages, leading off from the side of the still chamber at different points in its height.

243,080—June 21, 1881. CHARLES T. PLACE. *Distillation of petroleum and other oils.*

Claims the combination of a still and goose neck, the latter of which is provided with ascending and descending pipes or branches, the descending pipe or pipes passing through the still or other heating chamber.

266,990—November 7, 1882. WILLIAM C. HALL. *Apparatus for separating petroleum vapors.*

Claims the combination of a still, a vertical pipe, secured to the top thereof, a series of pipes connected at different heights to the vertical pipe and united together again at a distance from the still, with a steam pipe connected with the uppermost pipe, cocks and traps upon the lower pipes, leading from the still.

284,331—September 4, 1883. DAVENPORT ROGERS. *Self heating and separating still.*

Claims an apparatus for distilling petroleum, consisting of a heater, a coil of pipe arranged within said heater and connected with the source of supply of the petroleum to be distilled, a still, a pipe leading from the coil into the still to supply petroleum to said still and maintain a shallow body of oil in said still, a trap between the heater and still to eliminate the water from the petroleum before the petroleum enters the still, pipes leading from the still back into the heater to convey the vapors from the still to the heater, wherein such vapors serve to preheat the petroleum in the coil, graded eduction pipes for separating the vapors in the heater and taking off such vapors according to their gravity, and a pipe leading from the heater to the still furnace to enable the utilization of the incondensable gases as fuel, all combined and arranged to operate, whereby cold crude material is preheated by the vapors coming from the still, and such vapors separated according to the gravity and a continuous and constant distillation kept up.

Subclass 18.—Supplementary Heating.

50,276—October 3, 1865. JOHN ROGERS. *Improvement in stills for distilling petroleum.*

Claims the process of distilling petroleum or other hydrocarbon liquids by passing the crude oil through heated pipes or their equivalents in the interior of the still, for the purpose of freeing the same from their most volatile constituents.

54,218—April 24, 1866. H. A. SCHESCH. *Improvement in apparatus for distilling.*

Claims exposing the upper part or vapor space of a still to the action of an additional fire built in a secondary fireplace.

61,474—January 22, 1867. JOHN S. SHAPTER. *Improvement in petroleum stills.*

Claims the arrangement of boiler, superheater, and still, by which the heat from the boiler is made to pass through the superheater, and then through, under, or around the still.

90,284—May 18, 1869. JOSHUA MERRILL. *Improved manufacture of deodorized heavy hydrocarbon oils.*

This invention consists in producing heavy hydrocarbon oils, suitable for lubricating and other purposes and free from the characteristic odors of heavy hydrocarbon oils, by distilling from them the volatile matters from which the objectionable odors arise, and at the same time preventing new formations of such matters by keeping the temperature of the oil in the still below that at which these matters form by decomposition of the oil.

90,284—May 18, 1869; reissue 7,733, June 12, 1877. JOSHUA MERRILL. *Improvement in processes and apparatus for the manufacture of deodorized heavy hydrocarbon oils.*

Claims the mode of manufacture of deodorized heavy hydrocarbon oils, which, when finished, are distillates suitable for lubricating and other purposes, free from the characteristic odors of hydrocarbon oils, and having a slight smell like fatty oil, by distilling from them the volatile matters from which the objectionable odors arise and preventing the formation of such matters by keeping the temperature of the oil in the still below that at which these matters form by decomposition of the oil.

90,284—May 18, 1869; reissue 7,826, July 31, 1877. JOSHUA MERRILL. *Improvement in the production of deodorized heavy hydrocarbon oils.*

Claims heavy hydrocarbon oil, suitable for lubricating and other purposes, free from the characteristic odors of hydrocarbon oils and having a slight smell like fatty oil.

94,409—August 31, 1869. HENRY GROGAN. *Improved still.*

Claims a hot water condenser in combination with a suspended drum pipe and goose neck of the still, whereby the water in said condenser is heated by means of the steam discharged from the drum.

110,806—January 3, 1871. WILLIAM G. WARDEN. *Improvement in apparatus and processes for distilling oil.*

Claims the process of distilling oils, etc., by subjecting the same to the action of heat in a vessel a portion of which extends below the fire and in which a constant upward current from the said lower portion is maintained.

123,741—February 13, 1872. JOHN STUBER, JACOB STUBER, AND JOHN W. MAGER. *Improvement in distilling petroleum.*

Claims the process for producing continuous distillation of petroleum by means of supply tanks, the contents of which are heated before they are injected into the still, and which connect with a double acting pump by which a continuous supply of the heated liquid from the supply tanks is driven into the still, while the still is placed over a furnace for the purpose of keeping up the temperature of the liquid contained therein and injected into the same by the action of the pump.

218,901—August 26, 1879. JOSEPH C. ROBINSON. *Improvement in oil stills.*

The present invention has relation to that class of stills used for the purpose of manufacturing lubricating, illuminating, and other oils; and it consists in providing the feed pipe for oil with jackets near the top and bottom of the still, inclosing said feed pipe and steam pipes connecting the jackets, the steam pipes also having connection with the interior of the still, to which exit pipes for the steam are attached, the still, with its appurtenances, being also subjected to the action of fire heat, whereby a rapid and continuous distillation is effected, and the incoming oil warmed by exhaust steam before entering the still.

283,471—August 21, 1883. JOHN B. DUBLER. *Oil still.*

Claims, in an oil still, a boiler provided with the supplemental boilers extended down into the fire chamber and connected to the main boiler, and with a dome or domes, provided with a nipple plate, a support and resistance plates arranged therein, with a pipe leading from said boiler and dome.

342,565—May 25, 1886. GEORGE L. BENTON. *Apparatus for refining crude petroleum.*

Claims the combination with a furnace, of a heating chamber, a latent vaporizing pipe connected with an oil supply and situated within the furnace, a vapor chamber located above the furnace and directly heated thereby, and a condenser.

499,557—June 13, 1893. FREDERIC LENNARD. *Method of and apparatus for distilling tar, etc.*

Claims the process of distilling tar or the like, consisting in heating it while confined in coils or passages, to a degree which would cause its required constituents to vaporize if not thus confined, and causing the said tar or the like so heated to enter and its said constituents to vaporize in a scrubber into which steam or other disassociating agent is admitted.

SUBCLASS 19.—COAL OIL RETORTS.

15,643—September 2, 1856. CUMMINGS CHERRY. *Improvement in apparatus for distilling crude oil from mineral coal.*

Claims providing upright retorts for the manufacture of oil from bituminous coal with a closed top and an opening at their bottoms to be immersed in water.

22,407—December 28, 1858. LUTHER ATWOOD. *Improvement in apparatus for destructive distillation.*

Claims the combination and arrangement of a distilling tower and receiving vessel, with a steam blast or its equivalent in the combination, for the purpose of producing an induced current.

22,573—January 11, 1859. JAMES O'HARA. *Improvement in retorts for distilling oils from coal.*

Claims the employment, in an upright retort for distilling coal, of a revolving screw of a circumference smaller than the interior of the retort, so applied that while by its revolution it produces a continuous elevation of the central portion of the charge it permits and causes a continuous descent of the surrounding portion by gravitation, and thus produces a positive continuous and uninterrupted upward and downward circulation.

22,798—February 1, 1859. NATHANIEL B. HATCH. *Improvement in retorts for distilling coal oil.*

Claims the application and use in retorts used in distillation of coal or other substances from which oil or gas is producible, of a sweep bar or arm with plates attached, and operated so as to push or spread the material placed within over the floor or bottom, and at intervals discharge the same continuously in openings at or near the edge of the retort.

23,006—February 22, 1859. LUTHER ATWOOD. *Improvement in apparatus for destructive distillation.*

This invention consists in combining a vertical combustion tower or fireplace, open at the top, and in which fuel is burned with a downward draft, with a vertical distilling tower or chamber, in which the substance acted on is placed, and with a continuous strain blast or other controllable means of producing a draft through the apparatus in such manner that the products of combustion from the combustion tower enter the distilling tower at the bottom and pass up through it and the mass of fragments it may contain.

23,337—March 29, 1859. LUTHER ATWOOD. *Improvement in apparatus for destructive distillation.*

This invention consists in combining a vertical distilling tower, or chamber, arranged so as to receive both the fuel and the substance operated on, with a condenser and a means of controlling or regulating the draft, by which the products of combustion of the fuel are circulated through the mass acted on, so that the process of decomposition can be carried on below a temperature that would effect combustion before the liquid and volatile products have been driven off by the heat, the whole apparatus being so arranged and combined as to use the current of products in its natural or upward direction.

24,211—May 31, 1859. ROBERT W. HAZLETT AND JOHN H. HOBBS. *Improvement in retorts for distilling coal oil.*

Claims constructing a horizontal retort with a pan or flat-shaped base and inclined upper sides or top, and with open conduits or gutters running from end to end of the retort, and arranged on the inner sides thereof and set inclining and emptying into the neck of the retort.

24,212—May 31, 1859. J. E. HOLMES. *Improvement in retorts for distilling oil from coal.*

Claims the employment, in a retort for distilling oil from coal, of a central perforated tube suspended from the mouthpiece, an open space being also left below the bottom of the tube for the removal of the coke residuum through the mouth.

26,000—November 1, 1859. H. K. SYMMES. *Improved apparatus for distilling coal.*

Claims an oil retort in combination with the gas retort or its equivalent for the purpose of saving the gas which escapes from the oil retort and to improve its quality.

27,603—March 20, 1860. C. I. VAN WYCK. *Improvement in apparatus for distilling oil from coal.*

Claims the construction of a retort with a grate in the bottom, and an inclined conductor below such grate, such conductor not being the outlet for the gaseous products of combustion of the fire by which the retort is heated.

32,373—May 21, 1861. GEORGE W. KIRCHHÖFFER. *Improvement in apparatus for distilling coal oil.*

Claims, in combination with an upright conical retort, a grinder arranged to rotate in proximity with the heated surface of the retort, for the purpose of pulverizing the coal and securing the contact of the same in a minutely divided state with the heated surface of retort.

34,195—January 21, 1862. JOHN BULLARD. *Improvement in apparatus for distilling coal oil.*

Claims an egg-shaped retort, arranged with draft opening at its lower end, so that the unburned contents of the retort will always be within the lines of the draft.

42,772—May 17, 1864. JOHN HOWARTH. *Improvement in apparatus for distilling off gases and vapors.*

Claims so combining devices for superheating steam, flues for the passage of products of combustion, and a suitable retort or retorts containing carbonaceous materials as to cause the internal heat, or that produced by the superheated steam, to always predominate over the external heat and perform the work of extracting the liquid and volatile products from the retort or retorts without producing destructive distillation.

453,386—June 2, 1891. GEORGE POTERIE. *Apparatus for producing coal tar and coke.*

Claims, in a plant for producing coal tar and coke, the combination of a series of ovens, the retorts arranged above said ovens and adapted to be heated thereby, a receiving vessel adapted to be partly filled with water and arranged below the ovens and connected individually with the retorts, the pipe in the top of said vessel, and a boiler intermediate of said ovens and the receiving vessel, a pipe in the boiler adapted to discharge steam in the pipes leading from the retorts, and a pipe leading from the receiving vessel to the furnace of the boiler to convey gas thereto.

759,988—May 17, 1904. SNYDER L. HAGUE. *Retort.*

Claims an apparatus for extracting oil from shale comprising a horizontal retort, a furnace beneath one end of said retort, a series of connected flues extending beneath said retort from the furnace to a smoke vent, air valves in said flues, a revolving conveyor to move the shale from the cooler to the hotter end of said retort, and a steam jet to drive the vapors from the hotter toward and out through a vent in the cooler end of the retort.

775,448—November 22, 1904. SNYDER L. HAGUE. *Retort.*

Claims, in a horizontal retort for extracting oils from shale and heated to graded temperatures by a suitable furnace, a conveyor to turn the shale over and move it along the retort from its cooler to its hotter end, cross partitions in said retort above and partly around said conveyor, and inlet and outlet pipes connecting with the apartments formed by said partitions.

Subclass 20.—Coal Oil Retort, Rotary.

20,026—April 27, 1858. DAVID ALTER AND SAMUEL A. HILL. *Improvement in revolving retorts for distilling coal, etc.*

Claims the use of retorts so constructed as to revolve continuously on their axes during the process of distillation.

20,026—April 27, 1858; reissue 663—February 8, 1859. D. ALTER AND S. A. HILL. *Improvement in distillation of oils from coal.*

Claims the destructive distillation of coal or other bituminous substances for obtaining the liquid products thereof in the form of what is known as "coal oils" by combining the use of a low temperature, not exceeding a low red heat, say about 850° Fahrenheit, with the use of retorts so constructed as to have a rotary or other equivalent motion for the purpose of agitating their contents.

20,587—June 15, 1858. T. D. SARGENT. *Improvement in retorts for distilling oil from coal.*

Claims the use of a cylinder retort made of clay, and so arranged as to revolve upon its axis during the process of distillation, or in place of a whole revolution making only three-fourths of a revolution and turning back again, thus producing an oscillating motion for a clay retort.

21,143—August 10, 1858. J. McCUE AND W. B. McCUE. *Improvement in retorts for distilling oils from coal.*

Claims the employment of a connecting pipe located in a retort in other than a central position, whereby we are enabled to conduct off the oleaginous products of the coal while the said retort partially revolves backward and forward on its axis.

23,362—March 29, 1859. JAMES GILLESPIE. *Improvement in revolving retorts for distilling coal oil.*

Claims securing a hopper-like cup in position by means of pins or their equivalents, surrounding the exit journal of each retort, a square-headed shaft passing through a hollow journal at the opposite end of the retort, and an external plate.

23,427—March 29, 1859. JOSEPH E. HOLMES. *Improvement in retorts for distilling coal oil.*

Claims the combination, with an internal vapor pipe, of a leg, so applied as to keep the mouth of the said pipe in the upper part of the retort, either by the direct action upon it of the force of gravitation or by its dragging in the coal or other matter in the lower part of the retort.

24,454—June 21, 1859. HENRY P. GENGEMBRE. *Improvement in retorts for distilling coal oil.*

Claims the use of an L-shaped retort combined with charging boxes, crusher, and discharging tube capable of being subjected to a degree of temperature at the end of the horizontal part, at which the residuum of the substances under treatment is discharged, higher than at the upright part at which the coal is charged, the whole so arranged as to avoid the admission of atmospheric air.

24,587—June 28, 1859. JOHN L. STEWART. *Improvement in retorts for distillation of coal.*

Claims an improved revolving web retort constructed not only with its induction and eduction openings arranged at or near one end of it, but with an endless or other proper carrier made so as to operate to receive the coal or matter to be distilled from or near one end of the retort and carry or force the same toward the opposite end thereof, and from thence backward toward the front end, and there discharge the same, causing the coal or matter to be distilled to pass twice through the retort or carbonizing chamber in such manner, and for securing advantages.

25,109—August 16, 1859. H. P. GENGEMBRE. *Improvement in manufacture of coal oils.*

Claims the continual, progressive, and gradual destructive distillation of coal or other bituminiferous substance for the purpose of obtaining therefrom the different products of distillation.

26,739—January 3, 1860. FRANKLIN W. WILLARD. *Improvement in coal-oil retorts.*

Claims the construction of coal-oil retorts with internal false or extra heads at either end of the retort, and held at proper distance from the heads proper by means of stays or studs, the intervening space between each of the false heads and the end of the retort being filled with clay or other nonconducting material.

27,542—March 20, 1860. H. P. GENGEMBRE. *Improvement in apparatus for distillation of coal.*

Claims a cylindrical or polygonal retort having at the center of both ends a hollow journal or tube, and being susceptible of receiving a continual or occasional movement of rotation or oscillation around its own axis, for the purpose specified.

SUBCLASS 21.—COAL OIL PROCESSES.

12,612—March 27, 1855. ABRAHAM GESNER. *Improvement in processes for making kerosene.*

Claims the process for extracting the liquid hydrocarbons, which I have denominated "kerosene," from asphaltum, bitumen, asphaltic, and bituminous rocks and shales, petroleum, and maltha by subjecting any of these substances to dry distillation, rectifying the distillate by treating it with acid and freshly calcined lime, and then submitting it to redistillation.

15,505—August 12, 1856. L. ATWOOD AND W. ATWOOD. *Improvement in the production of oil from cannel coal.*

Claims an improved oil obtained from natural bodies which alone or when mixed afford paraffine in destructive distillation, and which oil posesses certain described properties.

15,506—August 12, 1856. L. ATWOOD AND W. ATWOOD. *Improvement in preparing oil from bitumens.*

The manufacture and use of lubricating oils from bitumens, such as "Trinidad pitch" and "Barbadoes tar."

21,805—October 19, 1858. L. ATWOOD. *Improvement in extraction of volatile oils, etc., from coal.*

Claims the gradual and progressive formation at a comparatively low temperature of oleaginous vapors and oil from coal or other substances yielding pyrogenic oils by the gradual and progressive action of the heat of products of combustion upon and through the mass operated on.

22,406—December 28, 1858. L. ATWOOD. *Improvement in manufacture of pyrogenic oils.*

Claims forming oleaginous vapors from substances yielding pyrogenic oils by the action of the heat of a properly regulated current of products of combustion passing over and above the surface of the mass operated on, with or without the aid of external heat.

25,568—September 27, 1859; reissue 1,605—January 19, 1864. JOHN HOWARTH. *Improved method of distilling coal, etc.*

Claims distilling coal or other carbonaceous substances for the production of oils, gases, vapors, etc., by passing through the material to be acted upon a current of superheated steam in one body in a vertical plane, or nearly so, through an upright retort; that is, so that a body of superheated steam shall come in contact with every portion of the said material.

62,583—March 5, 1867. S. LLOYD WIEGAND. *Improvement in obtaining oil from paraffine, etc.*

This invention consists in exposing bituminous substances or other matter capable of yielding hydrocarbon oils or paraffine, in a close vessel or chamber, at a temperature below that requisite to decompose the oily or hydrocarbon vapors into permanent gas to the action of the gaseous products resulting from the decomposition of steam by passing it through carbon heated to incandescence, and subsequently extracting the oil and paraffine therefrom, either by pressure or by displacement, by which means I am enabled to separate the oils and paraffine from the crude material at a lower temperature than by any other previously known process, and to obtain both a better quality and better yield of products.

100,915—March 15, 1870; reissue 7,096—May 2, 1876. Division B. RUFUS S. MERRILL. *Improvement in heavy hydrocarbon oils for illumination.*

Claims as an article of manufacture an illuminating oil derived from petroleum, coal, shale, and schist, emitting no inflammable vapor at a temperature of less than 200° Fahrenheit.

100,915—March 15, 1870; reissue 8,728—May 27, 1879. RUFUS S. MERRILL. *Improvement in heavy hydrocarbon oils for illumination.*

Claims a heavy illuminating oil derived from petroleum, coal, shale, or schist, possessing an igniting point of about 300° Fahrenheit and a distilling point of about 600° Fahrenheit.

764,099—July 5, 1904. OTTO P. AMEND. *Process of desulphurizing oil or distillate.*

Claims the process of desulphurizing oil or distillate, which consists in removing the sulphureted hydrogen and neutralizing the fatty and organic acids contained therein; then in exposing the oil or distillate with its sulphur or sulphur compounds to the action of a soluble salt of copper in the presence of an alkali; in removing the excess of copper and copper hydrosulphides and exposing the oil or distillate and any hydrosulphide of copper remaining therein to the oxidizing effect of one or more oxidizing agents; in removing the resulting copper sulphates and settling the oil.

768,101—August 23, 1904. FRANK MACOMB WHITALL. *Process of treating and dissolving wurtzilite.*

Claims the process of treating wurtzilite, which consists in dissolving it in dead oil and then removing the solvent until the mass becomes consistent.

SUBCLASS 22.—COMPOSITIONS.

126,552—May 7, 1872. CHARLES A. JORDERY. *Improvement in solidifying oils.*

The object of this invention is to obviate several inconveniences which are experienced in transporting and handling petroleum, oils of schist, and their volatile essences, as well as oils in general. These products, by reason of their fluidity, are difficult to transport, and spread over all substances or bodies with which they come in contact; and, as regards the petroleum and other volatile oils, develop inflammable vapors, which, besides being dangerous, constitute quite a serious loss.

To remedy these difficulties the inventor solidifies these oils so as to obtain a new industrial product of a greater consistency, and disengaging or giving of less vapor, and capable of being transported and handled with greater facility, by mixing them with a small quantity of decoction of soapwort root.

127,568—June 4, 1872. ROBERT A. CHESEBROUGH. *Improvement in products from petroleum.*

Claims, as a new article of manufacture, vaseline, a thick, oily, pasty substance semisolid in appearance, unobjectionable in odor, becomes fluid at temperature varying from 85° to 110° Fahrenheit, and when fluid is transparent. It will not saponify, does not crystallize, and does not contain paraffine, and in this respect essentially differs from the heavy products of petroleum which have been subjected to destructive distillation and which are known as paraffine oils.

189,401—April 10, 1877. HERBERT W. C. TWEDDLE. *Improvement in petroleum products, and methods of obtaining the same.*

Claims the process for obtaining a new product from petroleum, the same consisting in washing the orange-colored, resinous, oily product obtained toward the close of the distillation of tar residuum, and subsequently driving off the solvent and recovering the heavy oil.

237,484—February 8, 1881. ROBERT A. CHESEBROUGH. *Process of refining vaseline.*

Claims the process of refining vaseline, petroleum oil, and residuum by keeping them just at the point of vaporization in an open vessel until the disagreeable smelling portions are driven off, and afterwards filtering through boneblack.

246,096—August 23, 1881. PETER DITMAR. *Process of solidifying crude and refined petroleum.*

Claims the mode of solidifying liquid hydrocarbons, such as crude or refined petroleum, naphtha residues, and the like, by dissolving 2 to 3 per cent of tallow soap in the hydrocarbon under the action of heat.

454,777—June 23, 1891. JOHN HENRY WILLIAMS STRINGFELLOW. *Process of solidifying liquid hydrocarbons.*

Claims the improvement in the process of gelatinizing or solidifying liquid hydrocarbons, which consists in first mixing with the liquid hydrocarbons a pulverized vegetable saponifier and afterwards adding to and intimately mixing with the first-named mixture a quantity of water.

641,962—January 23, 1900. BERNHARD HOFFMANN. *Process of solidifying petroleum.*

Claims the process of solidifying petroleum oil, which consists in mingling, approximately, ninety-one parts, by weight, of such oil with seven parts of curd soap, and two parts of stearin, heating the mixture until the soap and stearin are melted and thoroughly mixed, and then cooling and solidifying the same.

658,988—October 2, 1900. JOHN A. JUST. *Solidified mineral oil and method of making same.*

Claims a composition of matter, consisting of a mineral oil distillate, thickened or solidified by an aqueous solution of soap, and a substance insoluble in said distillate, and forming with water at ordinary temperatures a tenacious or viscid solution, and,

The process of solidifying mineral oil distillates, which consists in emulsifying such distillates by shaking a quantity thereof with a suitable quantity of a solution of a caseinate and soap in water, and in then gradually adding and incorporating more of such distillates by agitation.

761,939—June 7, 1904. FRIEDRICH BOLEG. *Process of making watery solutions of mineral and rosin oils.*

Claims the process of manufacturing clear and permanent watery solutions of mineral and rosin oils, consisting in treating a mixture of a mineral oil and a crude anhydrous rosin oil with steam, boiling the mixture and adding lye, separating the oil from the soap lye, and then treating said oil with distilled water and compressed air.

SUBCLASS 23.—BURNING FLUID.

1,453—December 31, 1839. ISAIAH JENNINGS. *Improved composition for burning in lamps.*

Claims the use and employment of "oil of whisky" with spirits of turpentine, alcohol, or lamp oil.

7,667—September 24, 1850. EPHRAIM HOWE. *Improvement in burning fluids.*

Claims compounding rosin and the essential oil of vegetables or grain (when the same is produced by distillation of whisky or alcoholic liquors, and thereby become a refuse article) for the purpose of making a material from which to make a gas; also for a burning fluid.

9,119—July 13, 1852. HENRY M. PAINE. *Improvement in benzole lights.*

Claims the mixture of alcohol, benzole, and such proportions of water as shall render the mixture milky in appearance and passing air through the same.

11,239—July 4, 1854. THOMAS DRAYTON. *Improvement in purifying oils.*

Purifies rosin oil and other oils by alcohol.

12,614—April 3, 1855. HENRY W. ADAMS. *Improvement in factitious oils.*

Claims the use of crude turpentine in a mixture made with it and fixed oils.

23,167—March 8, 1859. JONATHAN GRIFFIN. *Improvement in burning fluids.*

Claims a series of mixtures of crude coal naphtha, coal tar, gum turpentine, common wood tar, refined rosin oil, rosin naphtha, and benzol.

23,210—March 8, 1859. WILLIAM WILBER. *Improvement in burning fluids.*

Claims a fluid compound for burning in lamps, etc., made of coal tar, camphene, and alcohol.

25,362—September 6, 1859. N. A. DYAR AND J. F. AUGUSTUS. *Improved compound illuminating fluid.*

Claims a mixture of resin oil, fusel oil, and alcohol.

31,457—February 19, 1861. BENJAMIN F. HEBARD. *Improvement in burning fluid compositions.*

Claims the composition of fusel oil, kerosene, and spirits of turpentine and its combination with a perfuming essential oil.

34,772—March 25, 1862. C. W. PINKHAM. *Improved burning fluid.*

Claims a mixture of refined petroleum, benzole, naphtha or benzoin gum camphor, and essential oil.

35,527—June 10, 1862. SYLVESTER LEWIS. *Improved mode of treating oils and fats for rendering them more useful for burning in lamps, lubricating machinery, and other purposes.*

Claims the treatment of vegetable and animal oils and fats by the use of benzole or naphtha and annotto combined.

38,015—March 24, 1863. CHARLES N. TYLER. *Improved composition for burning fluids.*

Claims the compound produced by the combination of the mineral or earthy oils with fusel oil.

43,156—June 14, 1864. SYLVESTER LEWIS. *Treating oils and fats to form compositions for illuminating and other purposes.*

Claims the treatment of oleine expressed from fats and oils with benzine, benzole, or naphtha.

46,987—March 28, 1865. THOMAS J. BARRON. *Improved mode of preparing inflammable liquids so as to prevent accidents.*

Claims giving to explosive and inflammable oils and fluids used for illuminating and other purposes a bright distinct color to plainly distinguish them from other oils and fluids.

52,574—February 13, 1866. JOHN JANN. *Improved burning fluid.*

Claims the combination of benzine, sweet and linseed oil.

53,709—April 3, 1866. AARON C. VAUGHAN. *Improved burning fluid.*

Claims a burning fluid composed of benzine treated with resin and mixed with ordinary illuminating oil.

54,060—April 17, 1866. WILLIAM CORFIELD. *Improvement in the manufacture of burning fluid.*

Claims causing the alcoholic vapors from a still to pass through spirits of turpentine, or to unite with the vapors of the same.

54,061—April 17, 1866. WILLIAM CORFIELD. *Improvement in the manufacture of burning fluid.*

Claims mixing spirits of turpentine with fermented preparations of grain, or other materials used in the manufacture of alcohol, and distilling the mixture.

54,495—May 8, 1866. HORATIO B. BRACE AND WILLIAM T. SWART. *Improved compound burning fluid for illumination.*

Claims burning fluid for illuminating purposes composed of benzine, naphtha, or gasoline, carbonate of potassa, sulphate of alumina, muriate of soda, gum benzoin, gum camphor, spirits of niter.

55,880—June 26, 1866. DAVID MANSFIELD. *Improved burning fluid.*

Claims a burning fluid for illuminating purposes which is composed of alcohol, naphtha, white oak bark, alkanet root, slippery elm, gum camphor, saltpeter, and rock salt.

57,095—August 14, 1866. JAMES P. CROSS. *Improved burning fluid.*

Claims the combination of gasoline, 70° or 71° gravity; gum olibanum, cascarilla bark lichen.

57,390—August 21, 1866. E. D. SEELY. *Improved burning fluid.*

Claims the compound consisting of naphtha of about 65° gravity, white oak bark, alkanet wood, common salt, and cyanide of potassium.

57,727—September 4, 1866. JOHN JANN. *Improved burning fluid.*

Claims the combination of benzine, sweet oil, and oil of vitriol.

57,749—September 4, 1866. G. H. MELLEN AND J. C. HAZELTON. *Improved burning fluid.*

Claims an illuminating oil composed of naphtha (65°), carbonate of soda, oil of sassafras, alum, gum camphor, ground slippery elm, hydrate of lime, and essence of tar.

58,180—September 18, 1866. JOHN B. SCOTT. *Improved burning fluid.*

Claims the use of naphtha, potatoes, lime, soda, and curcuma.

58,905—October 16, 1866. GEORGE W. SPANGLE. *Improved burning fluid.*

Claims the method for rendering any of the products obtained from petroleum unexplosive and safe as a burning fluid by the use of sal soda and cream of tartar.

60,559—December 18, 1866. WILLIAM B. ROGERS. *Improved burning fluid.*

Claims a burning and carbonizing fluid which is composed of crude petroleum, gasoline, benzine, benzole or naphtha, caustic soda, or other suitable alkali, alum, fine salt, and manganese.

63,229—March 26, 1867. HENRY C. DEWITT. *Improved burning oil.*

Claims the mixture formed from and by action of gasoline, powdered alum, cut potatoes, carbon oil, alcohol, gum camphor, oil of sassafras, acetic potash, and sal soda.

63,777—April 9, 1867. ISAAC B. WIGGIN. *Improved burning fluid.*

Claims the incorporation of microcosmic salt with the compound of naphtha, kerosene oil, gum camphor, gum turpentine, oil lemons, and oil cloves, reference being had to the use of denser materials both in the composition of the hydrocarbons and the microcosmic salt, so as to make a fluid that can be burned in any kind of lamp without smoke, bad odor, or danger from explosion.

66,364—July 2, 1867. WILLIAM R. LOOMIS, NELSON WELLS, HARMON HITCHCOCK, AND SAMUEL G. STRYKER. *Improved burning fluid.*

Claims the manufacture of a burning fluid (crystallized oil) made by adding to forty gallons of naphtha, two pounds of alum, two pounds of common salt, one pound potash, and four ounces camphor gum, finely pulverized, and half a pint of spirits of niter.

74,756—February 25, 1868. GEORGE W. FLOWERS, JACOB C. HAPPERSETT, AND DANIEL W. HAPPERSETT. *Improved burning fluid.*

Claims the fluid prepared of gasoline, chloride of sodium, iodine, and quicklime.

75,147—March 3, 1868. DAVID W. FOWLER. *Improved illuminating oil.*

Claims the combination of naphtha, cupri sulphas, zinci oxidum, alumina sulphas et potassium, potassium chloras, camphora, aqua fortis.

82,151—September 15, 1868. JOHN E. NOYES. *Improved illuminating oil.*

Claims the burning fluid composed of coal oil, oil of rhodium, oil of origanum, salts of tartar, Rock Island salt, and common clay, which is then filtered.

98,883—January 18, 1870. JOSEPH PHILIPPS. *Improved mode of producing light by the combination of solid and liquid hydrocarbons.*

Claims the incorporation of one or several of the solid products of the distillation of wood or carboniferous bodies belonging to the coal series into one or several of the liquid products of the same, or their incorporation into naphtha, petroleum, or their distillates, so as to have highly carbureted compounds, and the combustion of these compounds by means of oxygen, for the purpose of producing light.

110,054—December 13, 1870. GEORGE LUPTON. *Improvement in purifying benzine.*

Claims the process for purifying benzine for illuminating purposes by the use of hydrated sesquioxide of iron, hydrate of lime, chloride of barium, carbonate of soda, and paraffine.

146,778—January 27, 1874. ALONZO W. PORTER. *Improvement in the methods of preparing and putting up illuminating oils so as to mark their quality.*

Claims as new articles of manufacture, illuminating oils so colored as to distinguish and mark the different grades or gravities of the safe or nonexplosive oils.

238,867—March 15, 1881. HENRY V. P. DRAPER. *Petroleum illuminating oil.*

The aim and effect of this improvement are to elevate the temperature at which petroleum illuminating oils give off explosive vapors and to raise what is termed the "burning point" of such oils; and the inventor claims—

The herein described compound consists of petroleum, illuminating oil, and chloroform.

250,830—December 13, 1881. WILBER R. MEEDS. *Lantern oil.*

Claims a lantern oil composed of one gallon lard oil, one gallon sperm burning oil, three and three-fourth pounds strained tallow, and one-half pint turpentine.

266,859—October 31, 1882. WILBER R. MEEDS. *Lantern oil.*

Claims in the manufacture of lantern or signal oils the compound consisting in the admixture, with a compound composed of commercial lard oil, commercial illuminating oil—that is, a mixture of lard oil and kerosene—of 300° fire test, and turpentine, in the proportions set forth, of a quantity of refined tallow oil equal in bulk or volume to one-half the volume of the commercial lard oil (irrespective of the lard oil contained in the commercial illuminating oil).

284,811—September 11, 1883. HOWARD R. BURK. *Coloring kerosene oil.*

Claims the method of coloring kerosene, which consists in coloring a substance soluble in or capable of being thoroughly mixed with kerosene, and then dissolving or mixing the said substance or vehicle in the kerosene.

304,390—September 2, 1884. ROBERT A. WILLIAMS AND JOHN BRAGG *Apparatus for coloring oil.*

Claims in a device or apparatus for coloring oil, a funnel having therein a compartment or chamber provided with a foraminous bottom and perforated cover, and oil space formed between the sides of the funnel and the partition of the chamber containing the coloring material.

313,795—March 10, 1885. AUGUST F. ZIMMERLING. *Gas fluid.*

Claims a gas fluid compound of fusel oil, carbon oil, consisting of petroleum distillate at a gravity of about 74° Baumé, and wood naphtha.

340,522—April 20, 1886. JAMES ROOTS. *Process of preparing burning oil for lamps and resulting product.*

Claims the process of improving the illuminating quality of hydrocarbon fluids for burning in the ordinary way in ordinary lamps, consisting in dissolving in such fluids naphthalene in proportion of from, say, 8 to 15 per cent, according to the volatility of the fluid.

512,834—January 16, 1894. ALONZO NOTEMAN. *Fuel oil.*

Claims as a new article of manufacture a hydrocarbon oil impregnated with an agent rich in oxygen. The gas employed may be pure oxygen, nitrous oxide, carbon dioxide, etc

557,291—March 31, 1896. ALBERT JOANNES TEMPERE. *Process of deodorizing petroleum and products thereof.*

Claims the process of treating petroleum for the purpose of deodorizing the same, which consists in adding amylacetate thereto.

616,838—December 27, 1898. EMIL GUMPOLDT. *Burning compound and method of compounding same.*

Claims a burning compound produced by the addition of grain soap to a burning fluid heated to or about the boiling point, agitating the emulsion thus formed, and adding shellac and allowing the resulting compound to cool and harden to a substantially solid form, the said ingredients being in the proportions substantially as set forth.

621,338—March 21, 1899. HEINRICH HEMPEL. *Process of producing carbonaceous agents for enriching spirits.*

Claims a process for producing a carbonaceous agent for enriching alcohol, which consists in mixing about five parts by weight of finely powdered naphthalene with about six parts by weight of an aqueous solution of sulphuric acid, gradually heating the mixture to about 160° Centigrade and retaining it at this temperature for about ten hours, allowing the mixture to cool, dissolving the result in water, distilling at 120° to 150° Centigrade, redistilling the products of distillation at a lower temperature, as specified, mixing the result with from two to six parts by weight of a volatile oil rich in carbon of the kind specified and adding the mixture to alcohol.

621,411—March 21, 1899. HEINRICH HEMPEL. *Process of producing luminous spirits.*

Claims a process for producing means for enriching alcohol with carbon, which consists in dissolving one part by weight of a hydrocarbon rich in carbon, such as naphthalene, in from three to six parts by weight of oil of turpentine, agitating the mixture and distilling at the temperature specified, heating the product to boiling point and stirring the same and finally adding to alcohol.

666,010—January 15, 1901 HEINRICH HELBING AND FRANCIS WILLIAM PASSMORE. *Thickening or solidifying mineral oils.*

Claims the method or process of thickening or solidifying a petroleum oil, which consists in treating the same with sodium salt of casein in aqueous solution and then hardening by means of formic aldehyde.

695,123—March 11, 1902. GEORGE EDWARD JAMES STREET. *Illuminating compound.*

Claims an illuminating compound for fairy lamps, bucket lamps, or lamps for ornamental illumination, consisting of a mixture of lard oil, neat's-foot oil, and camphor.

718,318—January 13, 1903. AUGUST H. CRONEMEYER. *Process of solidifying volatile hydrocarbons and alcohol and products thereof.*

Claims a product formed of one part sodium hydrate, one and one-half parts water, five parts alcohol, five parts stearin, two and one-half parts colophony, and fifty parts of an inflammable hydrocarbon.

SUBCLASS 24.—PARAFFIN.

8,833—March 23, 1852. JAMES YOUNG. *Improvements in the treatment of certain bituminous mineral substances and in obtaining products therefrom.*

Claims the obtaining of paraffine oil or an oil containing paraffine and paraffine from bituminous coals by the distillation of the bituminous material and the treatment of the distillates by sulphuric acid and then with caustic soda and the fractioning of the distillate by subsequent distillation.

52,283—January 30, 1866. H. P. GENGEMBRE *Improved process for extracting oils, etc., from minerals.*

Claims extracting oils, paraffines, or bitumens from minerals containing the same by submitting said minerals to the action of light liquid hydrocarbons in a liquid state or in vapor for the purpose of dissolving the oils. paraffine, or bitumen therein contained.

61,946—February 12, 1867. J. B. MERIAM. *Improved apparatus for extracting paraffine, etc., from oil.*

Claims a special form of refrigerator and press by which to express the oil from the mass while chilled.

65,275—May 28, 1867. JOHN E. RICHARDSON. *Improved process of chilling oils and fats.*

Claims the method of chilling oil, so that the ice is brought in direct contact with the lard.

93,739—August 17, 1869. C. CHAUNCEY PARSONS. *Improved process for purifying paraffine.*

Claims melting the paraffine with naphtha and cooling the same while continually agitating it.

102,135—April 19, 1870. FREDERICK LAMBE. *Improvement in treating paraffine and obtaining it in crystals.*

This invention relates to a novel mode of treating and purifying paraffine in the condition of loose crystals, the object being to expedite and economize the operations of separating the crystals from the fluid with which they may be naturally or otherwise associated and of washing and drying the crystals.

To this end the mixture of paraffine and oil is submitted to the action of a centrifugal apparatus acting on the principle of what is known as the hydro-extractor, by which means the solid paraffine is separated from the oil, the paraffine being retained within the apparatus and the liquid or oil passing away through the pervious sides of the same in obedience to the centrifugal law.

102,136—April 19, 1870: reissue 4,397—May 23, 1871. FREDERICK LAMBE. *Improvement in processes and apparatus for purifying paraffine and other substances.*

Claims in combination with a centrifugal extractor the employment of a close cistern or jacket whereby such apparatus is adapted for use in washing and drying crystals of paraffine or other substances or materials which have been treated with hydrocarbon or volatile solvents.

118,359—August 22, 1871. RICHARD GAGGIN. *Improvement in processes for deodorizing hydrocarbon oils.*

Claims pure, dry chlorine gas, either with or without atmospheric air, as a deodorizer of paraffine, kerosene, and other like oils.

129,463—July 16, 1872. SAMUEL H. CROCKER. *Improvement in the purification of paraffine.*

Claims in the process of purifying paraffine, subjecting the paraffine to the action of benzine or other like hydrocarbon at a temperature carried artificially above the melting point of the paraffine (say 80° or 90° Fahrenheit) and continuing them in solution at about the temperature stated till the benzine has taken up all the impurities of which it is capable and then pressing the paraffine in a warm bath.

131,137—September 3, 1872. HEINRICH UJKELY AND CHRISTIAN BEURLE. *Improvement in treating bituminous materials for the manufacture of cerasine or wax.*

Claims a product which is termed "cerasine" and which is obtained by treating ozocerite, asphaltum, mineral pitch, or other equivalent materials.

132,353—October 22, 1872. FRANCIS X. BYERLEY. *Improvement in purifying paraffine.*

Claims the improved process of obtaining or separating paraffine wax from the oil by the action of a pump connected with the receiver in which the paraffine is placed at a point below the perforated false bottom.

132,353—October 22, 1872; reissue 7,559—March 20, 1877. FRANCIS X. BYERLEY. *Improvement in processes of purifying paraffine wax.*

Claims the process of separating paraffine wax from the oil, which consists in removing the latter from a chilled mass of the paraffinized material by a continuous direct exhaust or suction action.

133,042—November 12, 1872. ROBERT M. LETCHFORD AND WILLIAM B. NATION. *Improvement in the treatment and purification of paraffine.*

Claims the treatment of paraffine with water in such manner as to wash out or remove the softer, more fusible, and impure parts, leaving the harder and purer paraffine in its original solid form.

164,672—June 22, 1875. FRANCIS X. BYERLEY. *Improvement in apparatus for purifying paraffine, etc.*

Claims the method of purifying and crystallizing paraffine and the like, consisting in crystallizing the substance in closed cylinders by heat or cold and straining off the waste, then purifying such crystallized substance in a receiver having a filter bottom, with the proper solvents.

177,347—May 16, 1876. JOSEPH B. MERIAM. *Improvement in separating paraffine from hydrocarbon oils.*

Claims the process of separating paraffine from hydrocarbon oils, the same consisting in first placing a mass of paraffine scales on a rigid screen secured within a proper receptacle and then forcing chilled hydrocarbon oil through said mass, the strata of paraffine scales that accumulates on said mass being removed from time to time.

181,814—September 5, 1876. FRANK Q. BARSTOW. *Improvement in apparatus for purifying paraffine.*

Claims in an apparatus for purifying paraffine wax or other analogous substances, the combination of a closed receptacle or vessel having a perforated bottom for supporting the substance to be operated upon, with a pipe for admitting the purifying element and pipe for the admission of compressed air to the chamber above the perforated bottom.

186,951—February 6, 1877. CARL MARIA PIELSTICKER. *Improvement in processes for refining crude ozocerite.*

Claims the process of refining crude ozocerite by melting in an agitator, then adding sulphuric acid, agitating, and, when a drawn sample, freed from impurities, presents a yellow color, drawing off the impurities and washing the ozocerite repeatedly with hot water, allowing it again to settle, and then agitating with carbonate of baryta and caustic soda; when sufficiently agitated drawing off the spent chemicals and adding to the ozocerite a saponifiable oil or fat, rosin, turpentine, or soap, and caustic soda, agitating, allowing to settle, drawing off impurities, washing repeatedly in hot water, allowing to rest, and, when the ozocerite is of a light yellow color, filtering it through animal charcoal, so as to obtain a whitish wax-like material suitable for similar purposes for which beeswax, paraffin, and stearin are now in use.

211,762—January 28, 1879. THOMAS MARRIN. *Improvement in purification of paraffine oils.*

Claims in the art of obtaining paraffine wax, clarifying the paraffine oil before congelation with sludge acid, by mixing and agitating the two, decanting the paraffine, washing it with warm water, and neutralizing any residuary acid with alkali.

215,471—May 20, 1879. FRANCIS MARION McMILLAN. *Improvement in processes for freezing and pressing paraffine oil.*

Claims the process of separating lubricating oil and refined paraffine contained in the product of crude paraffine distillate of petroleum in one continued process, by subjecting said product to a freezing temperature, and while in this state applying a sufficient degree of pressure, by means of condensed air forced into the chamber containing the material, to force the oil from the paraffine through a filtering diaphragm.

223,549—January 13, 1880. WILLIAM M. SLOANE AND ROBERT M. POTTER. *Process and apparatus for manufacturing paraffine wax.*

Claims the process of purifying, cleaning, and refining paraffine wax and other wax or fatty matters, consisting in introducing the wax or fatty matter and naphtha into a cylinder, heating the same by means which do not allow the contact of the heating agent with the wax or fatty matter and naphtha, agitating the said wax or fatty matter and naphtha until thoroughly combined, then passing the compound into a filter without allowing it to cool, keeping it heated as it passes through the filter, and subsequently separating the wax or fatty matter from the remainder of the compound.

235,057—November 30, 1880. WILLIAM M. SLOANE AND WILLIAM BELL. *Process of refining paraffine wax.*

Claims the process of purifying, cleaning, and refining paraffine wax, other waxes, fatty matters, rosins, and gums, consisting in forming a solution thereof, with naphtha or other solvent, through heat and agitation, subsequently cooling and congealing the same, next subjecting the same to pressure and then filtering, keeping the mass heated during the filtering.

242,554—June 7, 1881. HERMAN NEAHOUS. *Press for treating paraffine oils.*

Claims in a press for treating paraffine oils, an oil receptacle or press box having suitable discharge pipes, in combination with a stationary wax filter attached to and forming part of one of the heads of the press, and a movable wax filter attached to and forming part of the press plunger.

244,431—July 19, 1881. FRANCIS X. BYERLEY. *Apparatus for and process of treating paraffine.*

Claims the improved process of treating paraffine by one continuous operation, consisting in reducing the paraffinized oil to a frigid mass in a receiver, and then discharging it into a percolator, and while therein and in motion subjecting the mass in detail to the action of a solvent for the separation of the oil from the paraffine during its passage through the said percolator, assisted in its separation by the action of a pump or vacuum for drawing off the free oil and solvent.

248,735—October 25, 1881. DANIEL T. GRAY. *Process of and apparatus for purifying wax, fats, or resins.*

Claims the improvement in the process of purifying wax or equivalent material, consisting in causing a stream of wax, while in a fluid or melted state, and a stream of naphtha or other solvent to flow together, and thus form an intimate mixture or solution, and thence pass through a filter.

250,524—December 6, 1881. DANIEL T. GRAY. *Process of and machinery for refining and purifying paraffine and other waxy materials.*

Claims the process for purifying and refining paraffine and other waxy matters, consisting, essentially, in subjecting the crude wax to a solvent and heated air, under pressure, in a closed vessel, passing the mixture through a filter provided with a heating jacket, to remove the earthy matters, then freezing the wax in a closed chamber, then compressing it to remove the solvent, and then again melting it by steam or hot air to drive off all traces of the solvent.

266,929—October 31, 1882. HENRY WARDEN. *Filtering petroleum distillates for the separation of paraffine.*

Claims the process of first cooling petroleum distillate and then maintaining it in a cooled condition while it is being press filtered.

267,752—November 21, 1882. SOLOMON W. KIRK. *Separating wax from paraffine oil.*

Claims the improvement in the art of separating wax from paraffine oil, which consists in the addition of paraffine wax to the crude paraffine distillate of petroleum.

281,491—July 17, 1883. DANIEL T. GRAY. *Filtering apparatus for purifying paraffine, etc.*

Claims the combination, with one or more filter boxes constructed to admit air at the top, and a receiving tank for the filtrate, of a pipe, or passage for the removal of air and vapor from the tank, and an educting steam jet connected with said pipe or passage and discharging outwardly therein, whereby a partial vacuum may be maintained in the receiving tank.

284,437—September 4, 1883. EDWARD D. KENDALL. *Process of and apparatus for preparing petroleum jelly.*

Claims the method of producing a substance from petroleum residues resembling somewhat the material known as "petroleum jelly," and which process consists of the following steps: First, heating the said residues to nearly the boiling point of alcohol, or to a temperature of about 170 degrees, if the alcohol has a specific gravity of 0.816, and simultaneously heating a larger volume of alcohol to substantially the same temperature; second, thoroughly commingling the said heated residues and alcohol by mechanical agitation; third, subjecting the substances thus combined to the action of gravity and differences of temperature for the purpose of separating the insoluble elements from the hot alcoholic solution; and, fourth, drawing off the alcoholic solution into a settling and cooling tank, where, during the operation of cooling, the alcohol rises to the surface and is drawn off, to be returned to the original circulation, while the jelly is left in the cooling and settling tanks.

297,766—April 29, 1884. JEAN CHARLES OCTAVE CHEMIN. *Process of preparing ozocerite and other solid hydrocarbons.*

Claims the method of treating or preparing ozocerite and other similar hydrocarbons, which consists in first removing the earthy insoluble impurities by the means substantially as described, then heating the thus purified substance in a retort in connection with sulphur in about the proportion specified, and submitting the same to the action of superheated steam in the retort until it distills over.

306,653—October 14, 1884. ROLLIN H. SMITH. *Process of extracting paraffine from oils by filter press.*

Claims extracting paraffine or solid substances from oils or other liquids by a series of filter plates so arranged in a frame that the flexible rims of such plates, coming together, form a tight joint and an inner receptacle between the web of the plates for the deposit of the solid substances.

347,288—August 10, 1886. FRANCIS X. BYERLEY. *Purifying paraffine and extracting oil from oleaginous materials.*

Claims the method of treating materials containing bodies of different fusibility by forcing through the same gas or vapor heated to or above the melting or liquefying point of the softer portions, and below that of the harder portions, and withdrawing the liquefied from the solid portions.

369,902—September 13, 1887. GEORGE AAB AND SANFORD K. CAMPBELL. *Method of extracting paraffine or other bodies from petroleum.*

Claims the method of extracting paraffine or other bodies from petroleum, which consists in forcing the petroleum through a cloth previously coated or impregnated with paraffine, whereby the paraffine or other solids contained within the oil will be separated therefrom.

387,357—August 7, 1888. MOSES S. HIGBIE AND ALBERT W. DOUGHERTY. *Asphaltum compound and process of making the same.*

Claims the process of refining asphaltum, which consists in adding it in small quantities from time to time to a bath of melted paraffine wax and mineral oil and subjecting it to heat sufficient to melt it and to volatilize certain impurities therein contained.

387,358—August 7, 1888. MOSES S. HIGBIE AND ALBERT W. DOUGHERTY. *Bitumen compound and process of making the same.*

Claims the process of hardening bitumen, consisting in melting it with paraffine wax and subjecting the same to heat to remove the volatile impurities.

400,042—March 26, 1889. JOHN E. BICKNELL. *Process of purifying paraffine wax.*

Claims a process for purifying or refining a substance having portions of different fusibility, the same consisting in forcing up through the substance a fluid heated to or above the liquefying point of the softer portions of the substance, simultaneously disintegrating said substance, then gradually withdrawing a portion of the upper portion of said fluid, simultaneously floating off a portion of the substance treated liquefied at said temperature, and gradually introducing beneath the substance the fluid withdrawn and forcing it again through the substance treated, thus causing said fluid to have a constant circulation through the substance treated.

400,043—March 26, 1889. JOHN E. BICKNELL. *Process of purifying paraffine wax.*

Claims a process of purifying or refining a substance—such as paraffine or other like substance containing portions respectively of different points of fusibility—the same consisting in reducing the substance to a finely divided condition and then passing through said substance a fluid having a temperature substantially equal to or above the liquefying point of the softer portion of said substance and below the liquefying point of the harder portion of said substance, and removing the liquefied portion from the solid portion of said substance.

490,199—January 17, 1893. NORMAN MACFARLANE HENDERSON. *Treating or purifying paraffine wax and apparatus therefor.*

Claims in an apparatus for treating or purifying paraffine wax, the combination of a chamber having longitudinal and transverse heating pipes, metal trays carried by the transverse pipes, strainers consisting of frames carrying longitudinal and transverse wires and fine wire gauze on the wires supported at a small height above the bottom of the trays, the said trays provided with outlets below the said strainers, and overflow ducts from one tray to the next lower one, with swiveling nozzles communicating with the said outlets, gearing for simultaneously turning each set of nozzles and hoppers into which the nozzles discharge.

558,358—April 14, 1896. WILLIAM P. COWAN. *Apparatus for treating paraffine wax, etc.*

Claims the method of treating a mass of material of the nature described, to subject it progressively to different temperatures for the purpose set forth, which consists in pouring the mass in a melted condition into a receptacle provided with numerous fluid current conveying tubes, which are thereby embedded in the mass, passing through the tubes a cooling fluid and thus producing an approximate solidification of the mass, then passing through the tubes heating fluid currents of progressively higher temperature, and withdrawing from the mass and collecting the material as it melts.

653,235—July 10, 1900. ALANSON McD. GRAY. *Apparatus for molding wax.*

Claims a flat open-sided mold permanently closed at its bottom and ends and having an opening at the top for the introduction of the material, in combination with independent removable hollow chilling plates forming the closing sides thereof, a support upon which the mold and plates are mounted and upon which they are independently movable laterally or flatwise, and means, for circulating a cooling medium through the plates, whereby the mold and plates may be pressed together, thus closing the mold at its sides and separated after the material in the mold is chilled or solidified to permit the removal of the cake laterally from the mold.

689,381—December 24, 1901. EDGAR VON BOYEN. *Process of manufacturing mineral wax.*

Claims a process for producing, from bituminous brown coal, a wax-like substance, consisting of an acid and an unsaturated hydrocarbon, according to which an extract is first obtained from the coal by means of suitable solvents such as benzoin, benzene, and the like, which extract is converted into the mineral wax by distillation with superheated steam, under rarefaction.

690,693—January 7, 1902. EDGAR VON BOYEN. *Process of manufacturing mineral wax from bituminous brown coal.*

Claims the process for producing mineral wax, which consists in distilling bituminous brown coal, in a dry condition in the presence of superheated steam and then distilling the extract thus obtained, in presence of superheated steam and under rarefaction.

781,854—February 7, 1905. RICHARD THOMAS. *Cooler.*

Claims a cooler comprising, in combination, a series of closed cooling compartments the top and bottom of which are composed of cooling plates, an injector operating in each compartment between said cooling plates and passages whereby said compartments are connected through said cooling plates, the passage in each plate being at a different angle from the passage in the other plates to form a progressive series of passages around the center of the cooler, said cooling plates being hollow and provided with connections for the circulation of a cooling fluid through the series.

SUBCLASS 25.—PROCESSES.

36,632—October 7, 1862. A. H. PERKINS. *Improved process of treating coal tar to manufacture roofing cement.*

This process consists in igniting the bulk of coal tar itself about its surface, and at the same time subjecting it to an agitation, thus feeding the flame and consuming and evaporating the portions necessary to be disposed of before the proper consistency can be attained.

135,879—February 18, 1873. PETER BARTHEL. *Improvement in treating asphalt.*

Claims the arrangement of a sieve in a kettle above the material to be dissolved.

159,655—February 9, 1875. HENRY H. EDGERTON. *Improvement in processes of treating hydrocarbons for making gas.*

Claims for use in the process of manufacturing illuminating gas from gas producing hydrocarbons by presenting hydrocarbons of the same constitution in the retort at the same time, the method of preparing said hydrocarbons, by separating the same into liquid subdivisions whose respective constituents have substantially identical decomposing points, as set forth, whereby any one of said subdivisions is available in liquid form for gas making purposes, independently of the others.

162,394—April 20, 1875. ARCHIBALD K. LEE. *Improvement in processes of reducing asphaltum to a liquid.*

Claims the process of reducing asphaltum to a liquid, and holding the same in a fluid condition without heat or the use of dead oils, but through the action alone of a product obtained by the redistillation of the spirits of turpentine, and in then separating from the same the water, acids, and all resinous substances, and in then concentrating and rectifying the same.

162,394—April 20, 1875; reissue 8,921—October 7, 1879. ARCHIBALD K. LEE. *Improvement in processes of reducing asphaltum to a liquid.*

Claims as a new article of commerce, fluid asphaltum, the same having been reduced to a liquid through the action of a solvent and without heat, for paving, roofing, and other purposes.

178,889—June 20, 1876. JOHN J. THOMAS. *Improvement in apparatus for separating ammoniacal liquor from gas tar.*

Claims the combination, in an apparatus for separating commingled liquids having different specific gravities, of a tank or chest, an inlet pipe, a series of vertical dividing plates, a lower transverse dam, and upper and lower delivery pipes.

236,995—January 25, 1881. EDWARD J. DE SMEDT. *Bituminous cement.*

Claims the improvement in the art of preparing coal tar products for use in bituminous cements or compositions for paving and other purposes, which consists in subjecting said products, while maintained in a heated condition, to the action of an oxidizing agent.

237,662—February 8, 1881. EDWARD J. DE SMEDT. *Bituminous cement.*

Claims the improvement in the art of preparing heavy petroleum oil for use in bituminous cements and compositions for paving and other purposes which consists in subjecting said products, while in heated condition, to the action of an oxidizing agent.

239,260—March 22, 1881. JULIUS I. LIVINGSTON. *Plastics from petroleum.*

Claims the process of making petroleum asphaltum by eliminating from the heavy residual product the coke or coke producing elements by precipitation, followed by distilling.

248,074—October 11, 1881. CYRUS M. WARREN. *Roofing, paving, and varnish material.*

Claims as a new manufacture, the bituminous residuum obtained by exposing wax tailings to a distilling process.

258,778—May 30, 1882. JAMES LIVESEY AND JAMES KIDD. *Mode of manufacturing naphthalene into a form for carbureting.*

Claims the process of obtaining refined naphthalene, consisting in first heating the crude naphthalene in a closed boiler, then passing a current of air over its surface for collecting the naphthalene, then conducting the air impregnated with the naphthalene into a condensing chamber, where the naphthalene is freed from the air, then reheating the collected naphthalene, and finally molding the same in refrigerated molds.

376,289—January 10, 1888. HEINRICH BUSSE. *Process of making artificial or elastic bitumen for paving.*

Claims the process of manufacturing artificial elaterite from naphtha or liquid bitumens, consisting in subjecting the materials to a proper degree of heat, cooling and mixing them with vegetable oils, fatty or sebacic acids, treating the mixture with nitrous acid and compressed atmospheric air, and subjecting the entire mixture to a proper degree of heat.

387,357—August 7, 1888. MOSES S. HIGBIE AND ALBERT W. DOUGHERTY. *Asphaltum compound and process of making the same.*

Claims the process of refining asphaltum, which consists in adding it in small quantities from time to time to a bath of melted paraffine wax and mineral oil and subjecting it to heat sufficient to melt it and to volatilize certain impurities therein contained.

399,073—March 5, 1889. GEORGE H. PERKINS. *Process of distilling petroleum.*

Claims the process of distilling a petroleum product and separating its distillates, which consists, in treating said product with heat in a still, in passing the resulting vapors through a suitable condenser, in conveying, by suitable conduits, the lighter distillates to a proper receiving vessel, and in conveying the heavier distillates, which have not been trapped back into the original still, to a supplementary vessel or still in which they may, without other heat than that originally derived from the original still, further separate into heavier and lighter products.

481,391—August 23, 1892. JACOB P. ENGLE. *Recovering waste products of petroleum.*

Claims the process of separating waste petroleum products in which the water globules are covered with petroleum oil, consisting in mixing and agitating with such combined products a dry material which breaks up the globules by absorbing the lighter oil and spirit, then discharging the heavy oil or residue and water into a tank to enable the said heavy oil or residue to settle, and finally separating the water from the heavy oil or residue.

488,767—December 27, 1892. JOHN LAING. *Destructive distillation of mineral oils.*

Claims an improved process for treating heavy mineral oils to obtain lighter oils, the said process consisting in distilling the oil from a series of compartments or vessels, the liquid in all of which is in communication, and passing the volatilized matters through condensers from each compartment or vessel to the next in order and from the last to ordinary condensers, the condensed products from each condenser but the last being led to the body of oil under treatment in the successive compartments.

500,252—June 27, 1893. HERMAN FRASCH. *Composition for purifying Canadian or similar petroleum and process of making such composition.*

Claims the new composition for removing sulphur compounds from Canadian and similar "skunk" bearing oil, consisting of one or more metallic oxides soluble in such oil (as the oxides of lead and copper) in a finely divided form on or in particles of a comminuted refractory carrier or vehicle, said composition being characterized by practical homogeneity, in consequence of the presence together of the said metallic oxide and the said carrier or vehicle in the individual fine grains or granules of the composition, and also by the velvety fineness and permeability of the said metallic oxide.

505,416—September 19, 1893. ARTHUR F. L. BELL. *Process of extracting and refining asphaltum, etc.*

Claims the improvement in the process of extracting and refining asphaltum, mineral pitch, bitumen, Trinidad lake pitch, petroleum, petroleum oils, paraffine, paraffine oils, and kindred substances, which consists, first, in heating in water and keeping in motion the material with its carrying sand, or vehicle, whereby the former separates from the sand, or vehicles, and rises and floats on the surface of the water, and then in discharging the carrying sand, or vehicle, and subjecting the material to be refined to centrifugal force, whereby it is separated from the water with which it became impregnated in the process of separation from the sand, or vehicle.

512,348—January 9, 1894. WALTER S. WILKINSON. *Process of refining asphalt.*

Claims the process of refining natural asphalt, which consists in subjecting it in an open tank or vessel, in its crude state and under agitation, to the action of steam heat disseminated throughout it.

512,494—January 9, 1894. RICHARD D. UPHAM. *Process of refining asphalt.*

Claims the process of refining natural asphalt, which consists in subjecting it in an open tank or vessel, in its crude state, and while under subjection to the action either of steam or of fire heat, to the heating and agitating influence of steam disseminated throughout it by direct injection.

549,399—November 5, 1895. HARVEY LEE SELLERS AND HUGH RONALD. *Method of and apparatus for treating mineral pitch.*

Claims the method for treating mineral pitch, consisting in subjecting the material to the action of heat while submerged in hot water, to disintegrate the material, to separate the asphalt and asphalt oil from the impurities, and to permit the asphalt and oil to rise in the water to the surface thereof, discharging the sand and other impurities by gravity, connecting the sand discharge or outlet with a body of water, and maintaining a current through said body of water, whereby the sand and débris falling therein may be continuously discharged.

551,294—December 10, 1895. CLIFFORD RICHARDSON. *Process of dehydrating crude asphalt.*

Claims the process of dehydrating crude asphalt, which consists in successively and alternately grinding or pulverizing the same and drying it in order to reduce it from its natural state of emulsion to a dry powder.

580,592—April 13, 1897. ARTHUR F. L. BELL. *Apparatus for refining asphaltum.*

Claims in an apparatus for refining asphaltum, a rotatable closed drum for receiving the charge of material, means for admitting air or steam to the interior of the drum, and means for permitting the escape of the gases therefrom, consisting of the hollow axle of the drum provided with openings into the drum and a conical shield surrounding the axle and protecting said openings.

581,451—April 27, 1897. ARTHUR F. L. BELL. *Apparatus for refining asphaltum.*

Claims in an apparatus for refining asphaltum the combination of a stationary casing or shell and an interior revoluble drum or cylinder having end openings and separated from said shell to form a circumscribing space, with which it communicates, said drum or cylinder having its inner face provided with means rigid therewith for advancing the material, means for supplying the material to said drum, means for effecting the flow of a solvent through the drum in opposition to the path of movement of the material therein, and means whereby the vaporized solvent may be recovered.

581,546—April 27, 1897. HANS A. FRASCH. *Method of and apparatus for refining asphalt.*

Claims the method of extracting bitumen from bituminous rock, which consists in exposing the rock in a series of closed and heated vessels to the action of a solvent, at a temperature less than the boiling point of bitumen and at or above the boiling point of the solvent, flowing the solution through the series of rock filled vessels from one end of the series to the other, condensing the vaporized solvent and returning it to either of the vessels, whereby a continuous circulation of the solvent is produced simultaneously with the onflow of the solution, and the solution finally concentrated in the last of the series of vessels.

597,892—January 25, 1898. WALTER S. WILKINSON. *Process of treating asphalt.*

Claims the process of desalifying and removing nonbituminous organic matter from asphalt, which consists, first, in comminuting it, and, second, in agitating the comminuted product in water.

611,620—October 4, 1898. CHAUNCEY B. FORWARD AND JOHN M. DAVIDSON. *Method of obtaining asphalt from crude petroleum and petroleum tar.*

Claims the process of making asphalt from crude petroleum by treating the crude petroleum with acid to separate the carbonaceous matter from the oils, washing the carbonaceous matter to free it from the acid, then mixing it with heavy hydrocarbon oil and subjecting it to a high degree of heat for a considerable period.

617,226—January 3, 1899. AUGUSTUS STEIGER COOPER. *Method of and apparatus for extracting bitumen from sand.*

Claims the method for separating bitumen from sand, consisting in subjecting the material to the action of crude petroleum oil to soften and dissolve the bitumen contained in the sand, and then subjecting the mass to the action of a benzine solvent for the bitumen, mechanically agitating the mass, separating the solution from the sand, evaporating the solvent from the asphalt, and returning the solvent in vaporized form to fresh portions of the oiled sands.

617,712—January 17, 1899. ARTHUR F. L. BELL. *Machine and apparatus for extracting and refining asphalt.*

Claims in an asphaltum extracting and refining apparatus, revoluble mixing vessel or cylinder provided on its interior with a helical vane to move the material longitudinally, longitudinal vanes set between the convolutions of the helical vane to raise and agitate the asphaltic material, a sealed steam-jacketed feedway to introduce the asphaltic material and means for introducing a liquid solvent to be incorporated therewith.

620,082—February 21, 1899. CHARLES E. ANTHONY. *Wurtzilite product and apparatus.*

Claims a soluble and fusible wurtzilite product possessing the characteristics of the crude material in form, elasticity, hardness, color, and electric properties.

629,059—July 18, 1899. FREELING W. ARVINE. *Method of separating emulsions.*

Claims the method of treating water-gas tar, which consists in adding a coagulent, filtering under pressure, and then heating.

630,496—August 8, 1899. HERMAN FRASCH. *Cleansing purifying agent employed in purifying petroleum.*

Claims as a step in the process of removing the sulphur compounds known as "skunk" from skunk bearing petroleums, by the subjection of such oil or its vapors of distillation in a heated vessel to a metallic purifying agent or purificator in a fragmentary condition, whereby the particles of such metallic purificator become surface coated with its sulphide, the removal or separation of such sulphide coating from the purificator when so coated, by subjecting it to the action of a solvent, either of the sulphide or of the metallic substance coated therewith, whereby the sulphide coating is loosened and detached from its surface, either by being itself dissolved in the solvent or separated by the action of the solvent on the surface of the purificator.

635,429—October 24, 1899. GEORGE F. CULMER AND GEORGE C. K. CULMER. *Process of making asphaltic fluxes.*

Claims the method of preparing asphaltic fluxes, which consists in dehydrating petroleum residuum, holding the mass in heated state sufficient to drive off water but below the pitch forming temperature, e. g., below 550° Fahrenheit, and simultaneously blasting the charge with air so as to profoundly modify the characteristics thereof, thus markedly lessening the petrolene content and markedly increasing the asphaltene content without material loss through destructive distillation, while the volume and specific gravity of the finished batch remain essentially the same as in the dehydrated residuum.

635,430—October 24, 1899. GEORGE F. CULMER AND GEORGE C. K. CULMER. *Asphaltic flux.*

Claims a black, semisolid asphaltic flux devoid of pitch, the same consisting of dehydrated and oxidized petroleum residuum nearly alike in volume and specific gravity, with the original residuum but markedly higher in its content of asphaltene and lower in its petrolene than the residuum from which it was derived and possessing the characteristics of a product obtained by prolonged exposure of petroleum residuum to a heat below pitch forming temperature, e. g., below 550° Fahrenheit, under copious injection of air to transform the mass without material distillation.

646,639—April 3, 1900. JESSE A. DUBBS. *Distilling petroleum.*

Claims as an improvement in the art of vaporizing oil the method which consists in producing an initial vaporization of the oil by heating the same, then forcing air through the oil in such regulated quantities that the volume of air thus introduced will not at any time be greater than four times the volume of vapor given off by the oil and maintaining the oil at a vaporizing temperature during the introduction of air.

654,258—July 24, 1900. JOHN P. IHART. *Process of separating water from emulsions, etc.*

Claims the process of separating water from mixtures, emulsions, and compounds of oil or tar and water consisting in gradually passing the mixture, emulsion, or compound to be treated into a mass of the dehydrated oil or tar previously heated to a degree of heat in excess of that which would cause the separation of water, as steam from a mass of hydrated oil or tar, whereby the water is driven off from the inflowing stream of hydrated oil or tar immediately on its becoming mixed with the heated dehydrated material.

655,430—August 7, 1900. ARTHUR F. L. BELL. *Apparatus for extracting and refining asphaltic material.*

Claims in an asphaltum extracting and refining apparatus, a stationary casing, a revoluble main cylinder therein, with means for heating the exterior of said cylinder, a central concentric hollow core or drum fixed within said cylinder and revolving therewith, with means for heating said drum, and means for introducing and removing the material to be treated within the annular chamber included between said cylinder and drum.

659,076—October 2, 1900. FREDERIC LENNARD. *Process of separating free carbon from tar.*

Claims the process of distilling tar to separate the free carbon therefrom, consisting in diluting the tar with an oil or spirit, which will, in combination with the said tar, produce a mixture having an appreciably lower vaporizing point than the tar alone has, and subjecting the mixture to the action of heat and of steam, and thereby effecting simultaneously the volatilization of the liquid portion and the deposit of the free carbon.

671,078—April 2, 1901. JOHN T. DAVIS. *Distillation of petroleum.*

Claims the process of producing a residuum suitable for use as a binder for artificial fuel, which consists in distilling crude petroleum in the presence of an oxidizing agent, and to a temperature approximating to but below 660° Fahrenheit, and continuing the distillation at such temperature until the residuum has reached the condition desired.

688,073—December 3, 1901. ALLAN WADE DOW. *Manufacture of asphaltic cement.*

Claims the herein described artificial paving asphalt, consisting of the product obtained from oils having asphaltic bases by prolonged distillation thereof at temperatures sufficiently high to produce severe cracking, said product being substantially insoluble in petroleum naphtha, combined with a suitable flux.

722,500—March 10, 1903. JAMES S. DOWNARD AND BYRON A. ROLSON. *Apparatus for treating rock asphalt.*

Claims an apparatus for treating rock asphalt, comprising a separator having a tank, a feed trough with orifices therein, means for feeding material to the trough, and slide plates adjustably mounted on the feed trough to control the orifices thereof.

734,482—July 21, 1903. SAMUEL RUCKER WHITALL. *Process of treating wurtzilite for paints, varnishes, etc.*

Claims the process of dissolving wurtzilite by subjecting it to the solvent action of petroleum or its distillates.

755,309—March 22, 1904. ALEXANDER NIKIFOROFF. *Manufacture of the benzols and their homologues.*

Claims the process of treating raw materials, substantially as set forth, for the production of an aromatic distillate capable of yielding benzol, which consists in decomposing the raw material under the effect of heat, in condensing the volatile distillate having a boiling point of 200° centigrade or under, and in subjecting such distillate to the effect of a temperature of about 750° centigrade under a pressure above that of the atmosphere, in collecting the distillate of the second decomposition whose boiling point is approximately 200° centigrade or over, and in separately collecting the aromatic distillate of the second decomposition whose boiling point is 200° centigrade or under.

768,796—August 30, 1904. LOUIS GATHMANN. *Process of distilling or refining hydrocarbon oils and spirits.*

Claims the process of distilling or refining hydrocarbon oils or spirits, which consists in causing a circulation of a gaseous fluid under diminished atmospheric pressure through said liquid to be distilled or refined, causing a fractional condensation of the distilled or refined product and returning said gaseous fluid through said liquid under treatment.

781,240—January 31, 1905. ERIC A. STARKE. *Method of rendering asphaltic oils more liquid.*

Claims the process of rendering heavy mineral oils more liquid, which consists in subjecting the oil to a partial distillation at a temperature ranging from 500° to 650° Fahrenheit and reuniting the distillate and residuum and mixing the mass thoroughly.

805,116—November 21, 1905. Serial No. 170,223, August 20, 1903. GEORGE H. BRADFORD. *Process of distillation.*

Claims the vacuum process of distilling, which consists in drawing the vapors of distillation to a height greater than the height to which the liquid being distilled can rise in a vacuum, and then delivering such vapors to a condenser.

807,983—December 19, 1905. JAMES PHILIP WINTZ. *Process for treating petroleum oils.*

The invention consists also in cleaning and purifying the asphaltum by washing it in an alkaline solution, and the inventor—

Claims a step in the process which consists in separating asphaltum from crude petroleum oil by means of gasolene and sulphuric acid, treating the separated asphaltum with gasolene, water, and caustic soda, and then passing the asphaltum so treated through an evaporator.

SUBCLASS 26.—CHEMICAL.

11,203—June 27, 1854. ABRAHAM GESNER. *Improvement in kerosene burning fluids.*

Claims the distillate having a boiling point of 150° F. and specific gravity 0.750, obtained from petroleum, maltha, bitumen, and the like by dry distillation, treatment with sulphuric acid and lime, and subsequent distillation.

11,204—June 27, 1854. ABRAHAM GESNER. *C kerosene.*

Claims as a new composition of matter the fraction obtained in the distillation of petroleum, maltha, or soft mineral pitch, asphaltum, or bitumen, by dry distillation and subsequent treatment with powerful reagents or redistillation, which has a specific gravity of 0.8 and a boiling point of 350° F.

11,205—June 27, 1854. ABRAHAM GESNER. *Improvement in kerosene burning fluids.*

Claims the distillate having a boiling point of 250° F. and specific gravity 0.775 obtained from petroleum, maltha, bitumen, and the like by dry distillation, treatment with sulphuric acid and lime, and subsequent distillation.

13,358—July 31, 1855. S. MEREDITH. *Improvement in the distillation of cannel or other bituminous coals.*

Claims the production of naphtha, benzole, and other hydrocarbon liquids by the distillation of cannel or other bituminous coal in an atmosphere of heated hydrogen gas or in a retort to which a stream of heated hydrogen gas is admitted during the distilling process.

22,727—January 25, 1859. E. N. HORNER. *Improvement for process of extracting oil from coal, shale, and other minerals.*

Claims the use of a mixture of cream of tartar, common salt, and slaked lime for the purpose of condensing the oleaginous vapor produced by the dry distillation of coal, shale, or other bituminous minerals, extracting the oil from the gas and depriving the gas of its inflammable quality, and throwing off the sulphurous vapor.

31,982—April 9, 1861. JAMES J. JOHNSTON. *Improvement in the distillation of hydrocarbon oils.*

Claims the process and method of purifying, decolorizing, and deodorizing rock or petroleum oil by distilling it with common wood charcoal.

36,419—September 9, 1862. ANTONIO MEUCCI. *Improvement in treating petroleum and other oils to produce a vehicle for paints and varnishes.*

Claims the employment or use of hyponitric acid in treating petroleum, kerosene, or other oils, and the mixing petroleum or other oils after they have been exposed to a current of hyponitric acid with linseed or with linseed cakes and fish oil.

40,068—September 22, 1863. R. N. WARFIELD. *Improvement in deodorizing petroleum, naphtha, etc.*

States that "The process of deodorization now in general use is to introduce 10 per cent of sulphuric acid into the distilled oil and agitate the mass. When settled, the acid is drawn off. The result is to only change the odor, not to reduce the volatility, and to destroy an equal amount of oil to that of the acid introduced. To destroy the floating particles of acid, a strong solution of caustic soda is introduced, which neutralizes the acid and changes a portion of the oil to soap, and is passed off at the additional expense of the destruction of a portion of the oil."

And he claims in lieu of this, deodorizing petroleum, naphtha, etc., by the introduction of a volume of steam into the liquid beneath its surface in such a manner that the steam is distributed throughout the contents, and removes the gas by its passage through the oil, and passing the steam through a box, or its equivalent containing chloride of lime, muriate of ammonia, and stone lime, so that the steam becomes impregnated with the principles of those elements prior to entering the oil.

42,671—May 10, 1864. SYLVESTER LEWIS. *Improvement in deodorizing petroleum, etc.*

Claims the use and application of ashes and charcoal for the purpose of deodorizing petroleum and kerosene oils, naphtha, benzole, and benzene, and the process of filtering the same through the above ingredients, without reference to the exact proportions of such ingredients, which vary somewhat, depending upon the state of the oil to be deodorized.

43,325—June 28, 1864. JOSHUA MERRILL. *Improved mode of purifying hydrocarbon oils.*

Claims in the process of purifying hydrocarbon oils, treating them with sulphate of soda, in combination with the use of caustic or carbonate alkalies.

45,007—November 15, 1864. WILLIAM ADAMSON. *Improved apparatus for purifying mineral oils.*

Claims the mode of purifying mineral oils by mixing the oil with acids or alkalies and washing the mixture with water in a tank or reservoir by means of a paddle wheel.

48,367—June 27, 1865. ROBERT A. CHESEBROUGH. *Improved process for distilling petroleum.*

Claims the combination of bone dust, pulverized oyster shells, and cotton cloth for purifying, filtering, and deodorizing petroleum, naphtha, and heavy oil.

49,502—August 22, 1865. ROBERT A. CHESEBROUGH. *Improved process for purifying coal oil, etc.*

Claims the use of boneblack for purifying petroleum or coal oils by filtration.

51,557—December 19, 1865. ROBERT A. CHESEBROUGH. *Improvement in refining petroleum by filtration.*

Claims the use of peat charcoal, either by itself or in combination with other substances, for purifying or refining petroleum by filtration.

51,558—December 19, 1865. ROBERT A. CHESEBROUGH. *Improvement in refining petroleum by filtration.*

Claims the use of alumina and of substances containing alumina, either by itself or in combination with other substances, for purifying or refining petroleum by filtration.

52,897—February 27, 1866. HENRY T. SLEMMER. *Improvement in the manufacture of lubricating oil.*

The nature of this process consists in returning to the still the heavy products of the distillation of petroleum, denominated "naphthalene" and "paraffine," adding thereto a strong solution of caustic alkalies, either potash, soda, or any other alkali, and redistilling, steam being introduced when at or near the boiling point. The first products of the distillation—naphtha—and the lighter naphthalene oil or distillate being removed, the remaining distillate is received in the

receiver. This is then passed into a washer or agitator and thoroughly washed with a hot solution of alkalies, the alkali subsiding and being drawn off. It is then washed with hot water to remove the alkali. The object of the alkali is to remove the free acid produced by the distillation. It is then allowed to subside, the oily product being drawn off into another receiver. This is then frozen to crystallize the naphthalene and paraffine. The oil is then strained from the crystallized products at a temperature of 26° to 40° Fahrenheit. This produces an oil of 30° to 33° Baumé's hydrometer, of grea tlubricating properties, free from gum or acid, and adapted equally well for light or heavy bearings.

And he claims the production of an oil of the gravity as herein set forth and the rejecting of the first products of the distillate until it approximates 38° Baumé's hydrometer, and subsequent washing and treatment, and as a new manufacture, the lubricating oil prepared substantially as described.

53,656—April 3, 1866. ROBERT NEWALL. *Improved method of deodorizing petroleum.*

Claims deodorizing petroleum and other hydrocarbons by treating and washing them with a solution or lye containing chloride of lime, soda ash, and common lime, or their several equivalents, in the proportions stated.

54,192—April 24, 1866: LEANDER M. MOTT. *Improvement in the manufacture of lubricating oil.*

The nature of this invention consists in, first, reducing the oil by evaporation caused by applying steam or heat directly to the boiler containing the oil and heating the same until the desired gravity is obtained, after which to each gallon of oil to be treated is added 5 ounces of common salt, 5 ounces of unslaked lime, 1½ ounces of saltpeter, three-fourths of an ounce of potash, and the whole boiled together until a proper consistency is obtained and the oil is thoroughly deodorized.

54,267—April 24, 1866. JOHN FORDRED. *Improved method of purifying hydrocarbon oils.*

This invention has for its object the substitution of an alkaline preliminary treatment in lieu of the acid process, it being found that when the crude or distilled oils or products are submitted to the previous action of a caustic alkali a very large proportion of the coloring matter and other constituents are separated therefrom, and that, when such partially purified oils are subsequently treated according to the ordinary or any well known method of purification, not only is the subsequent purification facilitated. but the proportions of acid and alkali are materially lessened, and the products obtained are of superior quality.

After the oils have been subjected to any of the foregoing processes of purification or refining, or when such oils have been refined by any other process, the inventor found that a turbidity which is possessed by some of these oils may be removed, and that they may be made bright by filtration through a bed or filter composed of what is known as "Fuller's earth," or that the Fuller's earth may be mixed with the oil and then allowed to subside. The oil will then be found to be much brighter and quite freed from the dull or opaque appearance it originally possessed.

54,978—May 22, 1866. H. K. TAYLOR AND D. M. GRAHAM. *Improvement in treating oils.*

Claims the treatment of petroleums and other similar hydrocarbons by means of nascent hydrochloric acids, chlorine, fluorine, or other equivalent chemical reagent, so as to change the constitution of the oil and purify it; and the use of sulphuric acid, nitric acid, or salts, containing these or either of them, when used in combination with other materials, for the purpose of treating petroleum or other hydrocarbons.

54,984—May 22, 1866. P. WEISENBERGER. *Improved process of refining hydrocarbon oils.*

Claims the process of purifying distilled petroleum to other liquid hydrocarbons, without the aid of any alkalies, by means and with the use of water at 212° F., or approximate degree of temperature.

55,426—June 5, 1866. C. L. MOREHOUSE. *Improved process for preparing stuffing for currying.*

Claims the mode or process of clarifying paraffine oil by the use of a blast of air in jets, for agitating the oil while treating the same with a large proportion of sulphuric acid, thus checking the excess of chemical heat; the use of hot water in washing the oil; and the use of a blast of air from an ice chamber for crystallizing the paraffine.

56,276—July 10, 1866. WM. H. SANGSTER AND THEO. C. SPENCER. *Improvement in distilling petroleum.*

The invention consists in dispensing with the condensing worm or its equivalent now in common use for condensing the vapor of petroleum during the process of distilling, and so constructing and arranging the still that the vapor is brought directly in contact with a moving body of cold water, through which it rises to the top of the tank made to receive it.

59,751—November 20, 1866. H. K. TAYLOR AND D. M. GRAHAM. *Improvement in treating hydrocarbon oils.*

Claims, first, the disposing affinity of sulphuric acid, causing a chemical combination of the gases used with the oil.

Second. The disposing affinity of sulphuric acid in the treatment of hydrocarbons, that its use in connection with other substances, solid, gaseous, or fluid, by means of which the energy combination of these substances or parts of them with the hydrocarbons is very much increased.

Third. Treating oil by means of air and acid gases.

60,290—December 4, 1866. HENRY C. VAN TINE. *Improvement in refining petroleum.*

Claims the refining of petroleum or carbon oil without the aid of artificial heat, by means of the series of operations consisting substantially of the use of sulphuric acid, sulphate of zinc, sugar of lead, and bichromate of potash, or their equivalents, for separating the heavy carbons and impurities, the neutralizing of the acid and washing with water, combined with the subsequent exposure of the oil thus heated in shallow pans to the action of the atmosphere.

60,757—January 1, 1867. ORAZIO LUGO. *Improvement in deodorizing petroleum.*

Claims the use of chromic acid and hypochlorite of soda, or their equivalents, for the purpose of deodorizing offensive smelling kinds of petroleum.

63,749—April 9, 1867. THOMAS RESTIEAUX. *Improvement in deodorizing petroleum.*

The nature of this invention consists in the application of quicksilver in connection with nitric acid, muriatic acid, or a mixture of nitric acid and muriatic acid, or in any other way, to petroleum or any of the products of petroleum.

65,137—May 28, 1867. DEXTER SYMONDS. *Improved mode of purifying and deodorizing oils.*

In the operation the crude oil is placed in a still, and to, say, 30 gallons is added about 10 gallons of strong lime water, in about the proportion of 1 peck of lime to 8 gallons of water, according to the strength of the lime, and sometimes chloride of lime. Heat is applied and is continued until the oil and lime water have been sufficiently agitated, by boiling, to bring all the particles of oil into contact with the lime water, which acts as a disinfectant or neutralizing agent, to neutralize or expel the unpleasant odors from the oil. Before the oil and lime water in the still have reached a boiling point, the lighter portion of such oil begins to pass off, and continues to pass off during the boiling operation. This light oil, in its passage from the still to the condenser, in a state of vapor, passes through water strongly impregnated with lime or chloride of lime, by which it is sufficiently deprived of its unpleasant odor; but the heavy oil is sufficiently deodorized in the still, as it does not pass off in vapor, but remains in the still long enough to be acted upon by the lime water therein.

65,313—May 28, 1867. WILLIAM VAN WYCK. *Improved composition for filtering petroleum, sirups, and other liquids.*

Claims the application of the compound of soluble animal matter, chalk, and wood charcoal, for the purification of petroleum and other oils, sugars, sirups, and molasses, and spirituous liquors, by filtering these substances through the above-mentioned compound, or by any mode equivalent to filtration.

65,999—June 25, 1867. A. M. BURKE AND STEPHEN WRIGHT. *Improved mode of treating hydrocarbon oils.*

Claims the process of consecutively treating oils first by alkali in the still and subsequently by the use of acids in the agitator as a continuation of the said process.

81,071—August 18, 1868. FRANÇOIS LOUIS DE GERBETH. *Improvement in the manufacture of compound oils.*

Claims the production of an oil resembling linseed oil, and applicable to painting and varnish making, from a mixture of petroleum or coal oil, or such like hydrocarbon and rosin oil, such oils being treated with oxidizing agents, ozonized air, galvanic electricity, and driers;

The treating petroleum, coal oil, or similar hydrocarbon oil with oxidizing agents, and galvanic electricity, so as to improve the color;

The production of a spirit similar to turpentine, from a mixture of light petroleum or coal oil, or other similar light hydrocarbon oil or spirit, and light rosin oil or spirit, such oils or spirits being treated with oxidizing agents, ozonized air, and galvanic electricity; and,

The apparatus for the treatment of oils and spirits by means of ozonized air.

88,978—April 13, 1869. CHARLES C. PARSONS. *Improved process of purifying petroleum.*

The invention consists in passing the vapors of the petroleum or other hydrocarbon, while the atmospheric pressure is removed, through a suitable vessel containing either carbonaceous matter or metallic oxides, or both combined.

By exhausting the vapors by an air pump or suitable means, so placed that the vessel containing the purifying material shall be between it and the still, the vapors are drawn through the purifying material without any increase of pressure, thus at a low temperature, and without the injury resulting from overheating.

For a purifying material, for ordinary petroleum, either wood or animal charcoal, in as fine a state of division as will permit the free passage of the vapors, is preferred. When the hydrocarbons contain sulphur or other specially deleterious substances, oxide of iron, calcium, or other metals may be used, either by themselves or in combination with the charcoal.

91,654—June 22, 1869. THOMAS E. MERRICK. *Improved lubricating oil from petroleum.*

Claims the process of first removing by distillation the lighter products of crude petroleum oil until the gravity is reduced to any gravity between thirty-five (35) and twenty-five (25) Baumé, and then treating it with sulphuric acid, hot water, alkali of caustic soda, or soda ash, and water in the prescribed proportions.

99,728—February 8, 1870. JOSEPH A. TATRO. *Improved process of treating petroleum.*

Having distilled the crude oil, driving over everything that will go over in the worm of the still, and having, say, 100 gallons of product, take from one-fourth per cent to 2 per cent of sulphuric acid and pour it into the whole product and mix thoroughly. When thoroughly mixed, then add lime, partially or wholly slaked, in almost a dry state, sprinkling it over the oil and allowing it to subside into the oil and act upon it. The quantity of lime added is about 3 per centum. Gases will now rise through the oil, the mass meanwhile being stirred. When the gas ceases to rise, add 3 per centum more of lime, in all about 6 per centum. The lime and the gas evolved therefrom combine with those ingredients of the oil which render it dangerously inflammable and raise the fire point to a perfectly safe degree, from 140° to 160° Fahrenheit, according to the duration and strength of the chemical action.

101,284—March 29, 1870. OSCAR LOEW. *Improved method of bleaching and refining oils.*

Claims a cold process for bleaching and refining animal, vegetable, and mineral oils.

106,233—August 9, 1870. JOSEPH A. TATRO. *Improvement in refining petroleum.*

Claims the process described of applying in about the proportion specified to the whole product arising from the distillation of crude petroleum, sulphuric acid, and chloride of lime.

110,054—December 13, 1870. GEORGE LUPTON. *Improvement in purifying benzine.*

Claims the following process:

To forty (40) gallons of benzine add ten (10) pounds of hydrated sesquioxide of iron and ten (10) pounds of hydrate of lime. This mixture should be thoroughly agitated and allowed to stand twenty-four hours. The fluid should then be drawn off and eight (8) ounces of chloride of barium added to it, and the mixture again agitated and allowed to settle. After that one (1) pound of carbonate of soda is thrown in and well mixed with the fluid. Ten (10) pounds of refined paraffine is next dissolved in the fluid, which should stand four or five days before being used.

113,782—April 18, 1871. ROBERT G. LOFTUS. *Improvement in the purifications of oils and fats by acids.*

This relates to the treatment of rosin oil, and claims:

The employment of naphtha or a solvent in the process of treating oil with acid and alkali, and subsequently subjecting the treated oil to the action of steam in a still, or to distillation, all substantially as and for the purpose of separating the solvent from the oil.

116,852—July 11, 1871. CHARLES C. MENGEL AND ALOIS PÖHR VON PÖHRNHOFF. *Improvement in converting the residuum of petroleum into oil.*

Claims the conversion of the tarry residuum of petroleum distillation into illuminating oils by dropping into it water in a liquid state, or liquids containing water, while it is subjected to a high degree of heat in a still.

125,067—March 26, 1872. CHARLES C. MENGEL AND ALOIS P. VON PÖHRNHOFF. *Improvement in the manufacture of illuminating oils.*

Claims the manufacture of illuminating oil from crude oil without having recourse to lead and sulphur to effect its deodorization, by introducing water in a liquid state, or liquids containing water, drop by drop, onto the surface of the heated oil in the still and afterwards condensing the vapors thus eliminated and passed off from the still.

127,446—June 4, 1872. JAMES YOUNG. *Improvement in treating petroleum and other hydrocarbon oils.*

Claims the treatment of petroleums and paraffine oil with muriatic or hydrochloric acid.

139,009—May 20, 1873. JOHN JAY LOONEY. *Improvement in treating heavy petroleum.*

Claims the treatment of crude or heavy petroleum, previous to distillation, with a compound or mixture of benzine and sulphuric acid.

146,405—January 13, 1874. EMIL SCHALK. *Improvement in refining petroleum and other oils.*

Claims the process of refining distilled petroleum by sulphurous acid and ammonia gas.

161,672—April 6, 1875. HENRY DUBBS. *Improvement in compounds for decolorizing petroleum.*

Claims the improved compound for decolorizing petroleum or other oils, consisting of lime and sawdust combined.

164,694—June 22, 1875. AUGUSTUS T. SCHMIDT. *Improvement in refining oils.*

Claims in refining oils the process of subjecting the oils to distillation in the presence of a sulphite or hyposulphite, and in treating oils, the process of washing the distillate in a bath of water holding a hyposulphite or hypophosphite in solution.

216,518—June 17, 1879. HENRY F. HOWELL. *Improvement in processes of converting crude petroleum, without practically changing its volume, into a uniform, purified, and deodorized oil, which may be distilled without the coming over of naphtha, etc.*

Claims the process of converting crude petroleum and analogous oils into a substantially uniform fluid of the same homologous series, practically without changing its volume, which consists in subjecting the crude oil to the action of chlorine gas, whereby a certain proportion of the hydrogen element is replaced by an equivalent of the gas.

240,093—April 12, 1881. MARTIN CONNELLY. *Process of deodorizing and refining petroleum.*

Claims the process of deodorizing crude petroleum, consisting in heating the petroleum in an open vessel, and in suspending the deodorizing materials in a solid state in the oil, and heating together the oil and said suspended materials, and afterwards withdrawing the said deodorizing materials in a body from the oil.

240,094—April 12, 1881. MARTIN CONNELLY. *Petroleum products and process of obtaining and deodorizing the same.*

Claims the process of treating crude petroleum for the obtaining therefrom of an odorless anhydrous oil, consisting in first heating the petroleum in its natural state until it is freed of water, and afterwards introducing anhydrous or unslaked lime (calcium oxide) in proportions substantially such as specified, and heating said lime and oil together while entirely isolated from other materials, and finally separating the lime from the oil, whereby the oil is left without any foreign materials therein.

257,961—May 16, 1882. THOMSON McGOWAN. *Process of and mechanism for distilling hydrocarbons.*

Claims the process for the removal of sulphur from petroleum consisting in introducing oxygen and an alkali simultaneously into the body of the petroleum during distillation and when the temperature thereof is 300° F. or above.

275,565—April 10, 1883. HANS BRACKEBUSCH. *Process of deodorizing solutions of colophony in heavy hydrocarbons.*

Claims the process of deodorizing and refining solutions of colophony in heavy hydrocarbons, which consists in treating the same with nitric acid and neutralizing the nitro combinations resulting from the reaction by means of sulphuric acid and iron filings, substantially as and for the purposes specified, and in or about in the proportions set forth.

289,788—December 4, 1883. HEINRICH UJHELY. *Process of decolorizing and deodorizing heavy mineral oils.*

Claims the process of decolorizing and deodorizing heavy mineral oils, which consists in dissolving them in light hydrocarbon oils, adding to the solution the insoluble residuum obtained in the manufacture of ferrocyanide of potassium, boiling the mixture, filtering the same, and finally distilling from the filtrate the hydrocarbon solvent.

299,167—May 27, 1884. JOHN ROWSELL. *Process of bleaching, deodorizing, and sweetening benzine.*

Claims the process of deodorizing, etc., petroleum benzine wherein a given mass of the same is first treated to an application of sulphuric acid, then to a solution of a suitable alkali, and lastly to a solution of saltpeter and sulphuric acid, a washing with water being preferably resorted to after and between each of the aforesaid applications, said chemicals being used in the proportions and in the manner specified.

299,324—May 27, 1884. RICHARD BAYNES AND JOHN FEARENSIDE, JR. *Process of purifying or refining petroleum and other distillable oils.*

Claims the process of bleaching and purifying dark-colored distillable oils, which consists in adding to the oil pulverized dry coke or charcoal impregnated with anhydrous chloride of zinc till it arrives at the consistency of mud, subjecting it to distillation, and then condensing the distillate.

305,180—September 16, 1884. HALVOR HALVORSON. *Method of dividing and distilling crude petroleum.*

Claims the process for dividing crude petroleum into two parts, designated "primary" and "secondary" oils, which consists in mixing together crude petroleum and benzine and volatilizing the benzine, whereby it is caused to carry over with it the primary oil, leaving the secondary oil behind.

312,605—February 24, 1885. LEON BLUMENTHAL. *Eliminating the smell of coal oil.*

Claims the process of eliminating the odorous impurities from refined kerosene, which consists in, first, subjecting the liquid to the action of induced air currents; second, adding about 1 dram of sulphuric ether to each gallon of the product; and, third, continuing the action of the air currents.

321,465—July 7, 1885. JULIUS H. TIEMANN. *Process of refining petroleum.*

Claims the process of removing sulphuric acid from petroleum distillates and producing a finished merchantable product, which consists in adding directly to such distillates—that is, next after the acid treatment—an anhydrous alkali, or alkaline earth or composition thereof, or an anhydrous compound of the metals, whereby any washing is avoided.

330,637—November 17, 1885. JULIUS H. TIEMANN. *Process of purifying petroleum.*

Claims in refining petroleum the method of effecting more immediate and intimate contact of the acid, which consists in diffusing or spreading the acid by mixing with the petroleum and acid a powdered siliceous or other inorganic substance of greater specific gravity than the oil, and which is insoluble in or unaffected chemically by the acid.

336,941—March 2, 1886. JAMES W. NORTON AND FRANKLIN H. ROUSE. *Process of and apparatus for distilling oil.*

Claims the oil still provided with a closed top having an opening, in combination with the condensing chamber arranged longitudinally above the still and connecting directly with the opening in which the hot air, gases, and vapors are received, and a reduced portion combined and communicating with the outlet end of the body portion and connecting with an exhaust power to withdraw the water, gas, and air, and pipes arranged in the enlarged portion, and adapted, respectively, to spray water and liquid chemicals on the hot air and gases, with receptacles for supply water and liquid chemicals thereto, and

The method of distilling petroleum oil, consisting of heating the oil at the bottom of the still, forcing hot air downward through the body of oil to give thereto a lateral motion, causing chemicals to be precipitated or mixed thoroughly with the oil by this action of the hot air, subjecting the gases, etc., arising from the body of oil to the combined action of chemicals and water spray in a condensing chamber, the water and chemicals thus mingling with the gases, and conveying the same into a receiving tank.

340,411—April 20, 1886. CHARLES LEOPOLD BAILLARD. *Process of treating mineral oils.*

Claims the process of oxidating mineral oils by treating the same with oleic acid of distillation or saponification, or with rancid oil or fat.

342,564—May 25, 1886. GEORGE L. BENTON. *Process of refining crude petroleum oil.*

Claims the process of refining crude petroleum, which consists in heating the oil to a temperature ranging from about 700° to 1,000° Fahrenheit, and under a pressure of about 500 pounds or more to the square inch, then causing the heated oil to expand into a chamber of approximately the same temperature, and finally conducting it into an ordinary apparatus wherein it is condensed.

370,950—October 4, 1887. DANIEL MACDUGALD KENNEDY. *Desulphurizing and purifying petroleum oils.*

Claims the process of combining the sulphur in the oil with the metallic matter contained in a solution of about equal quantities of sulphate of copper (blue vitriol), caustic soda, and chloride of sodium (common salt), and then separating such combined metallic matter and sulphur from the oil.

378,246—February 21, 1888. HERMAN FRASCH. *Refining Canadian and similar petroleum oils.*

Claims the process of purifying Canadian and similar petroleum oils which contain sulphur compounds whose presence gives to said oil the property of dissolving lead oxide by distilling the same with the oxidating oxides, especially the roasted and oxidated residues of previous operations, mixed with or dissolved in the oil under treatment.

379,492—March 13, 1888. WILLIAM H. PITT. *Process of distilling petroleum.*

Claims the process of distilling petroleum having sulphurous or other offensive odors, consisting essentially of vaporizing such liquid petroleum, then passing the vapors so formed through a receptacle heated at the same or a higher temperature than the vapors coming from the still, said receptacle being filled with a metal or metals—such as iron or metallic compounds—having an affinity for the sulphurous vapors and other objectionable compounds, whereby they are held and retained by such substance, and conducting away and condensing the balance of the vapors.

400,633—April 2, 1889. FRANCIS M. F. CAZIN. *Method of refining and deodorizing coal oil or petroleum.*

Claims the process of deodorizing oil, consisting in first passing the same in a finely divided state through water; second, passing the same through an alkaline solution; third, passing the same through a solution of a salt of a heavy metal; fourth, passing the same through a solution of sulphuric acid; fifth, passing the same through an alkaline solution, and ultimately washing the same.

407,182—July 16, 1889. JESSE A. DUBBS. *Process of refining oils.*

Claims as an improvement in the art of refining oils containing sulphur, the herein described method, which consists in adding arsenium or its salts to the oil, subjecting the compound to a volatilizing heat, and then condensing the vapors so produced, substantially as set forth.

407,274—July 16, 1889. HENRY R. ANGUS. *Process of purifying and devolatilizing petroleum distillates.*

Claims the process of obtaining purified and graded oils and naphthas from petroleum distillate, consisting in repeatedly subjecting the distillate to the action of heated water in closed tanks at increasing temperatures by passing the distillate upwardly through the heated water in said tanks, separately removing the volatilized product of each tank as the process advances, and condensing and discharging said products separated from each other and from the distillate.

408,472—August 6, 1889. JOHN KINGSFORD FIELD. *Process of refining mineral oil.*

Claims the method of refining mineral oil, which consists in acidifying the oil with fuming sulphuric acid, then subjecting it to agitation in connection with bleaching material, then again acidifying with sulphuric acid, and again subjecting to agitation in connection with bleaching material.

413,187—October 22, 1889. EDWARD D. KENDALL. *Process of freeing malodorous hydrocarbons from offensive odor.*

Claims the process of freeing malodorous hydrocarbons from offensive odor, which consists in subjecting the same to the action of chloride of sulphur.

414,601—November 5, 1889. LEVI STEVENS. *Process of distilling oils and oleaginous substances.*

Claims the process of distilling oils, which consists in admixing the same with steam, passing the compound through a molten mass of material, which will liquefy but not volatilize at a temperature sufficient to break up and volatilize the heavier products of the oil, and finally condensing the resultant vapor.

The process of distilling oils and oleaginous compounds, which consists in admixing the same with steam, vaporizing the compound, conducting the resulting vapor through a series of condensers, in each of which in succession it is subjected to a lower temperature, and drawing off the product of condensation from each condenser into a still or vessel heated to a temperature at which said product shall be redistilled to expel therefrom the lighter products, which may have been carried with it from the condenser.

419,347—January 14, 1890. ROBERT MILTON PERRINE. *Process of purifying and deodorizing crude petroleum.*

Claims the process of deodorizing and purifying crude petroleum oils, which consists in first agitating or stirring the same with chloride of lime for a period of five hours, more or less, and then adding sulphuric acid to complete the elimination of chlorine gas and to neutralize and precipitate the alkaline matters and other impurities, and finally drawing off or removing the purified and deodorized oil.

425,905—April 15, 1890. CHARLES RAVE. *Process of utilizing acid tar residuums.*

Claims the process of manufacturing bitumen and other products from crude oils, tars, pitches, and other hydrocarbonaceous matters, which consists in treating the crude hydrocarbons with sulphuric acid at a suitable temperature, thus forming clear oil or grease and an acid tar, macerating the acid tar with water and granular metal, such as described, out of contact with air, till the sulphuric acid and metal have combined, distilling the bitumen by fractional distillation, obtaining thereby various naphthas and oils till the residue is sufficiently hard for the purpose required.

440,880—November 18, 1890. ANSON L. MUNSON. *Process of treating coal tar.*

Claims the process of treating coal tar, which consists in subjecting the coal tar to a heat of 110° Fahrenheit, maintaining that heat without driving off the lighter volatiles until the solids are melted to a degree sufficient to be acted upon by the solvents, adding a saturated solution of chloride of zinc in the proportion of 2½ pounds to every 50 gallons of tar, and agitating the mass, then adding oil of turpentine during the agitation in the proportion of 5 gallons to every 50 gallons of tar, and continuing the agitation until the turpentine is thoroughly incorporated.

442,802—December 16, 1890. JOHN GARDNER AND JAMES F. HARRIS. *Process of refining hydrocarbon oils.*

Claims the process of refining oils, which consists in injecting a ferruginated liquid into a vaporizing chamber, intimately commingling a spray of oil therewith and vaporizing the same, condensing the vapors, and separating the sulphur compounds.

448,480—March 17, 1891. HERMAN FRASCH. *Process of and apparatus for refining and purifying petroleum.*

Claims the process of removing from petroleum the sulphur compound known as "skunk," consisting in vaporizing the petroleum and passing the vapors through a vessel containing an oily liquid holding in solution, or solution and suspension, a substance soluble in such petroleum and having an affinity for the skunk compound, and raising the solution into contact with the vapors above the liquid by causing a device to enter repeatedly into and agitate the liquid and raise upon the surface of the device a portion of the liquid into the space occupied by the vapors.

451,660—May 5, 1891. EDWARD DWIGHT KENDALL. *Process of refining hydrocarbons.*

Claims the process of purifying mineral hydrocarbon oils containing sulphur compounds, which consists in mixing the oil with mercuric chloride in solution and in subsequently removing the absorbed mercuric body from the oil by subjecting the oil to the action of a suitable sulphide.

451,724—May 5, 1891. THOMAS J. GORDON. *Process of purifying petroleum distillates.*

Claims the process of purifying petroleum distillates, which consists, first, in subjecting the same to the action of a chemical having an affinity for sulphur products, such as litharge, then admixing with the distillate thus treated sulphate of magnesium to precipitate the sulphur products and litharge, then adding an acid to precipitate the remaining sulphur and lead products, then adding an alkaline solution to neutralize the acid, and finally washing the distillate to remove the alkali.

465,708—December 22, 1891. CHARLES C. MENGEL, SR. *Process of refining petroleum and analogous oils.*

Claims the process of refining petroleum and analogous oils, consisting in vaporizing the oils, introducing into the vapor previously washed carbonic acid gas under pressure and in a heated state, conducting the mixture into extended pipes, subjecting the same to additional heat, and discharging the mixture into a condenser.

480,311—August 9, 1892. OTTO P. AMEND AND JOSIAH H. MACY. *Process of desulphurizing oils.*

Claims the process of desulphurizing oil, which consists in vaporizing the oil containing the sulphur and heating the oil vapor to a degree of heat at or above the boiling point of sulphur, exposing the oil vapor so heated to the action of one or more chemical reagents that will combine with sulphur or sulphur compounds, and then condensing the oil vapor.

480,312—August 9, 1892. OTTO P. AMEND. *Process of desulphurizing oils.*

Claims the process of desulphurizing oil, which consists in vaporizing the oil containing sulphur or sulphur compounds and heating the vaporized oil to a degree of heat at or above the boiling point of sulphur and then exposing the vaporized oil so heated to the action of one or more alkalies and then condensing the oil.

487,119—November 29, 1892. HERMAN FRASCH. *Refining Canadian or similar petroleum oils.*

Claims the process of removing the sulphur compound termed "skunk" from Canadian and similar petroleum, which consists in vaporizing the oil and subjecting the vapors after they are given off from the body of the oil to the action of an oily or resinous liquid holding in solution or solution and suspension one or more metallic oxides soluble in said oil, including the decomposable compounds of such oxides, and condensing such purified vapors.

487,216—November 29, 1892. HERMAN FRASCH. *Purifying petroleum.*

Claims the process of purifying petroleum of the Canadian and Lima class of distilling the said skunk bearing petroleum and subjecting the same to the action within the oil undergoing distillation of the salts of those metals which are precipitable by hydrogen sulphide in acid solution, as the manganates, chromates, borates, sulphates, carbonates, and the like.

501,988—July 25, 1893. FRANCIS J. CARMAN. *Process of refining sulphurous petroleum.*

Claims the process for desulphurizing oils, which consists in passing the oil vapors through a receptacle containing a mass of melted metal, which will reduce the sulphurous vapors to a common form of combination, and then combine with the sulphur.

503,028—August 8, 1893. GEORGE ARCHBOLD. *Method of and means for extracting hydrocarbons from bituminous rocks.*

Claims the method of separating earthy matters from the hydrocarbons in bituminous rock, consisting in subjecting a mass of said rock to the action of sulphurous acid.

507,441—October 24, 1893. HERMANN KOEHLER. *Process of refining petroleum.*

Claims the process of treating hydrocarbon oils which are impregnated with sulphur or sulphur compounds, for the purpose of preparing the oil for the removal of the sulphur by subsequent treatment, consisting in the following steps: First, vaporizing the oil by subjecting it to heat in a still; second, passing the vapors thus produced through lime heated to such a temperature that whitish visible vapors are evolved; and, third, condensing the vapor after its passage through the heated lime.

508,479—November 14, 1893. ADOLF KAYSER. *Method of deodorizing hydrocarbon oils.*

Claims the method of deodorizing hydrocarbon oils which consists in subjecting their vapors to the action of anhydrous nitric acid, either alone or in connection with hypochlorous acid.

522,028—June 26, 1894. WALTER B. PRICE. *Process of purifying illuminating oils.*

Claims a new process of purifying oils containing sulphur, which consists in treating the oil with nitric acid, nitrous acid, or nitric peroxide, and distilling the oil so treated with sulphuric acid.

523,716—July 31, 1894. ADOLPH SOMMER. *Process of desulphurizing mineral oils.*

Claims the improvement in the process of desulphurizing mineral oils consisting in volatilizing the same and passing their vapors through a body of anhydrous sulphate of copper, heated to a temperature about or above 130° centigrade.

525,811—September 11, 1894. HANS A. FRASCH. *Process of refining petroleum.*

Claims the process of refining petroleum or its distillates, which consists in transforming the sulphur and basic bodies contained therein into oxidized and chloric products by treatment with a substance containing free chlorine or chloric oxide, removing the soluble compounds by washing with water, taking up the compounds soluble in acid by treatment with sulphuric acid, converting the remaining chloric bodies into a double salt, which is insoluble in the soil, by treatment with a basic metallic salt, and finally removing such double salt by decantation or otherwise.

525,969—September 11, 1894. ADOLPH SOMMER. *Process of desulphurizing mineral oils.*

Claims the herein described improvement in the process of desulphurizing mineral oils, consisting in digesting them with dry sulphate of copper.

534,295—February 19, 1895. JULIUS J. SUCKERT. *Process of purifying hydrocarbon oils.*

Claims the process of refining hydrocarbon oil, consisting in adding to the same a body described capable of combining with sulphur in the oil, subjecting the mixture to heat and pressure, subsequently relieving said pressure and condensing any vapors arising from the heated oil.

537,121—April 9, 1895. CLEMENS LOSSEN. *Deodorizing mineral oils.*

Claims the process of deodorizing mineral oils, which consists in mixing the oils with cuprous oxide and then subjecting the mixture to heat until the acetylenes contained therein are destroyed.

542,849—July 16, 1895. HERMAN FRASCH. *Process of refining petroleum.*

Claims the process of purifying petroleum of the Canadian or Lima class from sulphur compounds consisting in subjecting such sulphur bearing petroleum to the action of nitrous acid fumes at the temperature and during the process of distillation.

543,619—July 30, 1895. HERMAN FRASCH. *Refining Canadian or similar petroleum.*

Claims the process of removing the sulphur compound termed "skunk" from Canadian and similar petroleum, which consists in vaporizing the oil and subjecting the skunk bearing vapors given off from the body of oil to the action in an undissolved condition of one or more of the oxides or oxygen salts of the metals of that class which are precipitated by hydrogen sulphide in acid solution and which form oxides soluble in skunk bearing oil.

548,391—October 22, 1895. WALTER B. PRICE. *Method of purification of mineral oils.*

Claims the improvement in the process of purifying California illuminating oils, which consists in treating the oil to be purified with strong sulphuric acid, at a temperature above the boiling point of water.

551,941—December 24, 1895. OTTO P. AMEND AND JOSIAH H. MACY. *Process of desulphuring petroleum distillates.*

Claims the process of eliminating sulphur or organic sulphur compounds from petroleum oil or distillate, which consists in subjecting the oil or distillate containing sulphur or organic sulphur compounds to the action of an oxide or hydrate of an alkali or alkaline earth or to a combination of both oxide and hydrate by bringing the same in contact each with the other and agitating them or one of them; in heating the oil or distillate and the contents thereof; in effecting the dehydration of the oil or distillate by introducing therein and agitating therewith one or more dehydrating agents, as terra alba (oxide of alumina), calcium oxide or other dehydrating agent, and precipitating the new sulphur compounds, which are formed by the action of the alkali or alkaline earth upon the sulphur or organic sulphur compounds in the oil, and then separating the oil or distillate from the precipitate.

558,747—April 21, 1896. CARLOS A. SMITH. *Process of refining oil.*

Claims in the process of refining sulphur petroleums the improvement consisting in exposing the crude distillate of such sulphur petroleum to the influence of an active plate or element, such as lead, and an inactive plate or element, such as carbon and then treating with an acid in the usual way.

560,463—May 19, 1896. FRIEDRICH BERG. *Refining petroleum or hydrocarbon oils.*

Claims in refining crude Ohio petroleum or other like sulphurous hydrocarbon oils, the process consisting in treating the crude oil prior to the distillation of the illuminating oil products, first, with a suitable acid, and, secondly, with a suitable alkali or base, all at a temperature of at least 110° Fahrenheit.

561,216—June 2, 1896. HERMAN FRASCH. *Distillation of petroleum.*

Claims the improvement in the distillation of petroleum, consisting in taking the distillate obtained by cracking heavier oils, and after the so obtained distillate has been treated with sulphuric acid redistilling the same with diffusion of alkaline material, such as lime, through the said distillate, the diffusion of the said material being effected through the whole body of the oil while this is suitably below the boiling point of water and continued through the subsequent rise of temperature to the boiling point of oil and the consequent evaporation of the said oil, so that said material is exhibited to the compounds which resulted from the action of the sulphuric acid upon the cracked oil as the same are decomposing from the commencement throughout the progress of the decomposition.

564,921—July 28, 1896. HERMAN FRASCH. *Art of purifying petroleum.*

Claims in the purification of petroleum, the improvement consisting in heating through hot gases of combustion a number of independent charges of small diameter of a purifying agent to an elevated desulphurizing temperature which is the same for the different charges, equalizing such temperature through the absorption and giving off of heat by a regulator between the charges of purifying material and the fire, dividing the vapors given off together from the same body of petroleum in distillation into a number of streams, subjecting these several streams separately each to the action of the purifying agent in one of said charges, and making such action alike on the different streams by forming a partial vacuum between the purifying agent and the condenser and thereby counteracting differences in the resistance of the several charges.

564,922—July 28, 1896. HERMAN FRASCH. *Process of and apparatus for refining Lima or similar petroleum.*

Claims the continuous process of removing skunk from Lima or similar petroleum, consisting in exposing a comminuted oxide or salt of copper or like metal to the vapors of such oil and (when the said substance is charged with sulphur) to air so as to revivify the same by oxidation of the metal and sulphur, all under the conditions of a noncaking temperature and an absence of compacting pressure, and then repeating the described operations under said conditions of heat and pressure, without removal of the said substance from the apparatus in which the process is carried on by the passage of skunk bearing vapors to decompose the skunk and of air to revivify the skunk decomposing substance.

564,923—July 28, 1896. HERMAN FRASCH. *Process of refining Lima or similar petroleum.*

Claims the continuous process of removing skunk from Lima or similar petroleum, consisting in exposing a purificator composed of a refractory fibrous material like woolly asbestos and a comminuted oxide of salt of copper or like metal adherent to the fibers of such material to the vapors of such oil and (when the substance is charged with sulphur) to air so as to revivify the substance by oxidation of the metal and sulphur, all under the conditions of a noncaking temperature and an absence of compacting pressure so as to induce or retain a swelled or expanded state of extreme subdivision in the substance which adheres to the refractory fibers, and repeating the described operations under said conditions of heat and pressure, without removal of said purificator from the apparatus in which the process is carried on by the passage of skunk bearing vapors to decompose the skunk and of air to revivify the skunk decomposing substance.

564,924—July 28, 1896. HERMAN FRASCH. *Process of and apparatus for refining Lima or similar petroleum.*

Claims the improvement in refining Lima or similar petroleum, consisting in burning the spent skunk decomposing substance for the purpose of revivification, keeping the degree of heat below a caking temperature by conducting away the excess of heat as generated by means of the oil in distillation, and conveying away and condensing the so generated vapors; and,

The combination with a still and a distilling chamber of a purifier box adapted to serve also as a revivifying furnace arranged in said chamber, a vapor pipe between the said box and the vapor space of said still (whether said pipe be or be not also in communication with the vapor space of said chamber), one or more air inlet pipes for said box, means for opening and closing said pipes, a condenser, a condenser connection for the said box, and a separate condenser connection for the said chamber (the last-mentioned connection being preferably by way of a companion purifier box).

565,039—August 4, 1896. GEORGE M. SAYBOLT. *Process of refining hydrocarbon oils.*

Claims the method of purifying petroleum distillate, which consists in treating it, after final distillation, with nonfuming sulphuric acid, and then removing the impurities remaining after the acid treatment by bringing the distillate into intimate contact with a finely divided, substantially nonalkaline substance without intermediate treatment of the distillate with water or alkali.

565,040—August 4, 1896. GEORGE M. SAYBOLT. *Process of refining petroleum distillates.*

Claims the method of purifying petroleum distillate, which consists in treating the burning oil distillate of petroleum of less than 0.850 specific gravity, after its final distillation, with nonfuming sulphuric acid, and removing the impurities remaining after the acid treatment by agitating such distillate with water and then agitating it with finely divided nonalkaline solid material, and thereby removing the sulphonic salts produced by reaction of the sulphuric acid with the oil.

572,676—December 8, 1896. HERMAN FRASCH. *Treatment of petroleum for removing sulphur compounds.*

Claims the process of treating oil of the Lima class, for removal of the skunk, by subjecting the skunk bearing oil during a distillation thereof to a pulverulent purifying material of metallic oxide having a basis of iron and copper in the intimate union resulting from a melting together of their compounds and admixture in the molten state and consisting of roasted and pulverized copper matte, the purifying material being used in the body of oil in distillation or brought into contact with the vapors after they have been given off from said body.

580,652—April 13, 1897. MAX SCHILLER. *Method of refining and purifying hydrocarbon oils.*

Claims the process of removing sulphur compounds from hydrocarbon oils, which consists in mixing the crude oil with zinc dust and substantially dry alkaline hydrate for the production of hydrogen to combine with the sulphur of said sulphur compounds, the proportion of zinc dust and alkaline hydrate being in excess of that required for the separation of hydrogen to combine with the sulphur compounds, and subjecting the same to the distilling operation.

583,779—June 1, 1897. JAMES R. WHITING AND WILLIAM A. LAWRENCE. *Process of and apparatus for deodorizing oils.*

Claims a process of deodorizing oil, consisting in first reducing the oil to a vapor, then passing said vapor through charcoal, then through limewater, and then condensing said vapor.

An apparatus for deodorizing the lighter products of coal or petroleum, comprising a heating cylinder, in which the material under treatment is to be vaporized, a container for charcoal having communication with said cylinder, a limewater cylinder communicating with the container, and a condenser communicating with said limewater cylinder.

586,520—July 13, 1897. GEORGE H. MOORE. *Process of refining petroleum.*

Claims the process of purifying Lima and Canadian petroleum oils, and petroleums of that class, by removing the nitrogenous compounds and traces of the phenylic and naphthalene series by means of a porous compound of sodic hydrate, calcic hydrate, and sulphate of soda applied to vapor of the oil previous to the removal of the sulphur.

595,788—December 21, 1897. HENRY J. SMALL AND HOWARD STILLMAN. *Apparatus for manufacturing benzene.*

The object of this invention is to effect the utilization of the liquid benzol which is obtained as a by-product in the operation of the "Pintsch gas" plant by the manufacture therefrom of benzene in a simple and inexpensive manner; and the inventor claims—

In an apparatus for the manufacture of benzene, the combination of an agitator, a compressed air supply pipe, a steam still, a condenser, and valved connections from the agitator to the still, from the agitator to a point of discharge, and from a source of compressed air to the agitator.

596,437—December 28, 1897. WILLIAM A. SMITH. *Process of refining oil.*

Claims in a process of refining refractory oils the following steps: Introducing terpene into the oil or distillate to be refined, subjecting the mixture to heat and removing terpene, whereby the oil or distillate is rendered amenable to further treatment.

597,920—January 25, 1898. ERIC A. STARKE. *Process of purifying and refining California petroleum oils.*

Claims the process of treating, purifying, and refining "California" petroleum oils, so as to produce from them illuminating oils, which process consists, essentially, in first removing the less refractory substances by treating said oils with a solvent or menstruum and then treating the resulting product with sulphuric anhydrid to remove the more refractory substances.

601,331—March 29, 1898. OTTO P. AMEND. *Process of desulphurizing refractory oils.*

Claims the process of desulphurizing and treating petroleum oil or distillate containing refractory sulphur compounds, as Lima or Canadian oil or distillate, which consists in treating the oil or distillate with sulphuric acid having a higher percentage of H_2SO_4 than is found in ordinary commercial 66° Baumé acid and containing SO_3 or anhydrous sulphuric acid; in repeating the application of such acid until a splitting up of the sulphur compounds in the oil or distillate is effected; then removing the acid sludge and exposing the split up sulphur compounds to the action of an agent or reagent having an affinity for sulphur; and in effecting the dehydration of the distillate.

604,280—May 17, 1898. HERMAN WOLF. *Process of and apparatus for refining crude petroleum, etc.*

Claims the process of refining petroleum and analogous oils, which consists in injecting a stream of sulphuric acid between two streams (one of which is oil) moving at different velocities; and,

A refining apparatus comprising a cylindrical casing provided with concentric inlet or injection nozzles and having a constricted portion above the nozzle mouths and below the upper extremity of the casing, said casing having its upper portion provided with a lid and its lower portion provided with lateral inlets.

604,515—May 24, 1898. JOHN BRAGG. *Process of deodorizing and purifying petroleum oil.*

Claims the process of deodorizing and purifying petroleum oil, which consists in first dissolving in the oil a metallic compound soluble in the oil and whose metallic constituent is combinable with the sulphur element of the oil, such, for instance, as an oleate or colophonate, subsequently breaking up the compound or emulsion thus formed by the addition thereto of a substance capable of reacting with the metallic element of the compound added, whereby the metallic constituents of the mass are caused to separate from the oil, and finally removing from the oil the separated impurities and precipitates, without distillation.

607,017—July 12, 1898. THEODORE F. COLIN. *Process of desulphurizing petroleum.*

Claims the process of purifying Ohio and similar petroleum oils, which consists in distilling the crude oil or distillate with a peroxid, from which the oxygen is liberated in the presence of the hydrocarbons at the normal temperature of distillation.

618,307—January 24, 1899. AUGUST WENDTLAND. *Process of removing green color from paraffin.*

Claims a process for removing the green color from petroleum residues which have been treated with sulphuric acid, which consists in treating the same with a soap composed of fatty acid and an alkaline solution, allowing the soapy and oily matters to separate, treating the oily portion with barium chlorid solution, and filtering such oily portion through boneblack which has been impregnated with alcohol.

620,882—March 14, 1899. ARTHUR J. BOOTE AND HENRY G. W. KITTREDGE. *Process of treating hydrocarbon oils for removing sulphur compounds.*

Claims in the treatment of oils for the removal of sulphur compounds contained therein, the method of first treating the oil with an alkaline solution of an oxid of lead, and then further treating it with a hypochlorite of calcium, and then removing the precipitate.

622,799—April 11, 1899. HERMAN FRASCH. *Process of and apparatus for purifying petroleum.*

Claims as an improvement in the art of purifying petroleums of the Canadian or Lima class, for the removal of the offensive sulphur compound contained therein, passing the vapors of distillation through a column or vessel containing metallic purifying material in divided particles, such vessel being revolved or agitated constantly or intermittently during the passage of the vapor therethrough for the purpose of removing from their surfaces, by the abrasion on each other of the particles of the purificator, the metallic sulphide which is formed thereon; and,

The combination with a petroleum still and a condenser of an agitatory or rotatory vessel for containing and cleansing a purificator interposed in the path of the vapors between the said still and condenser, and means for heating said vessel.

623,066—April 11, 1899. FREIDRICH BERG. *Process of refining petroleum.*

Claims the petroleum refining process comprising, first, a treatment of the crude oil with an alkali at a comparatively high temperature, maintaining this mixture at said temperature for several hours and stirring or agitating the mixture at intervals during this time; then removing or separating the alkali and foreign matter that has been precipitated or settled during said alkali treatment and permitting the alkali still contained in the oil to stand for several days at a moderate temperature and continue its work of destroying sulphurous compounds and impurities still remaining in the oil; then distilling the oil, and, finally, treating the distillate with sulphuric acid for the purpose of removing the water contained in the distillate.

640,918—January 9, 1900. ADOLPH KAYSER. *Method of refining petroleum and petroleum derivatives.*

Claims in the method of refining ill smelling or sulphur bearing petroleum, or petroleum derivatives, the step which consists in distilling the same by the application of heat to the still, mixing carbon with the oil vapor, and heating the mixture of oil vapor and carbon monoxid to the temperature necessary for causing the carbon monoxid to react upon the objectionable compounds in the oil vapor.

649,047—May 8, 1900. HERMAN FRASCH. *Art of purifying petroleum and products therefrom.*

Claims the process of making from Lima or Canadian petroleums, which contain the sulphur compounds termed "skunk," fair smelling reduced oil products for lubricating purposes, consisting in reducing the skunk bearing crude petroleum to a gravity of about 29° Baumé by evaporating the burning oil and other lighter portions at such temperatures and under such other conditions as to avoid the liberation of microscopic particles of carbon or other decomposition which would exclude the said residual product from the reduced oil class, and in subjecting the undistilled heavier portions of said skunk bearing petroleum in their natural state to oxidants which are without effect upon the hydrocarbons wherein the skunk is dissolved, so as to convert the skunk therein into inodorous oxidized compounds while preserving the lubricating quality of the said undistilled heavier portions of the crude petroleum, the addition of oxidant being before or after the evaporation of the said lighter portions.

649,048—May 8, 1900. HERMAN FRASCH. *Art of purifying petroleum.*

Claims the process of deodorizing oil of the Canadian or Lima class by the prolonged subjection of the skunk bearing oil to the action of an oxidating agent or agents in a closed vessel at a temperature above the distilling point of the said oil under atmospheric pressure and under a pressure of vapor in said vessel above the vapor tension of the oil at said temperature, so that the oil is retained in the liquid state during such subjecting, vaporization thereof being prevented by the excess of said pressure over the vapor tension of the said liquid oil.

655,500—August 7, 1900. THOMAS MACALPINE. *Process of refining mineral oils.*

Claims the process of refining petroleum and mineral oils, which consists in subjecting them to the action of a compound of acetylene and manganese.

658,857—October 2, 1900. THOMSON McGOWAN. *Process of desulphurizing petroleum oil.*

Claims the process of desulphurizing crude Lima or like sulphurized petroleum oil, which consists in distilling a mixture of sulphuric acid with said sulphurized oil which has not been previously treated so as to change the chemical character of the sulphur compounds therein.

666,446—January 22, 1901. JOHN W. WARREN. *Clarifying sulphurous hydrocarbon oils.*

Claims the method of clarifying sulphurous hydrocarbon oils, which consists in mixing with the oil disintegrated Wyoming rock clay, allowing the same to settle, and finally pouring off the oil.

683,354—September 24, 1901. FELIX C. THIELE. *Process of refining crude mineral oils and their distillates.*

Claims the process of refining crude mineral oils of the Lima type consisting in the addition of nitric acid thereto until sulphurous gases cease to be evolved; the conversion of the nitro and nitroso compounds into basic compounds by the addition of a nascent hydrogen producing substance until in a tested portion nitrous gases cease to be evolved in the presence of sulphuric acid, and the removal of the newly formed products by a subsequent acid treatment.

685,907—November 5, 1901. THEODORE F. COLIN. *Process of desulphurizing petroleum oils.*

Claims the process of desulphurizing petroleum of the Ohio class, which consists in mixing with the distillate concentrated sulphuric acid and some form of a metal, in a dry condition, which has a strong affinity for sulphur, and of which the sulphide is insoluble in the acid, so that the distillate will be subjected to the simultaneous action of the acid and said agent.

686,663—November 12, 1901. THOMAS MACALPINE. *Process of preparing an acetylene preparation of manganese.*

This invention consists in an improved process for preparing a special manganese compound which can be advantageously used in the purification of mineral oils; and,

Claims the process of preparing a manganese compound which consists in subjecting a solution or emulsion of compounds of the alkalies or alkaline earths to the action of acetylene gas and adding to the resulting product a solution containing manganese.

694,622—March 4, 1902. JESSE A. DUBBS. *Distilling oil.*

Claims as an improvement in the art of distilling oil, the method which consists in effecting vaporization of the oil by the combined action of heat and air forced through the oil, and in subjecting the vapor to a temperature higher than the vaporizing temperature of the oil.

705,168—July 22, 1902. JOHN W. WARREN. *Process of purifying hydrocarbon oils.*

Claims the method of clarifying hydrocarbon oils, which consists in treating the same with a solution of sugar of lead; absorbing the water and any foreign substances resulting from such latter operation by an addition of clay of Wyoming rock clay constitution; drawing off the distillate; treating it with sulphuric acid, neutralizing the same by an addition of said clay; drawing off the distillate; treating it with caustic potash; allowing it to stand; re-treating the distillate with said clay, and, finally, when clear, drawing off the distillate.

713,475—November 11, 1902. JOHN CÁRWILE MIMS. *Process of refining asphaltic mineral oils.*

Claims the process of removing asphaltum from mineral oils containing a high percentage of asphaltum which consists in adding to the oil a mixture of about 5 parts, by weight, of potassium bichromate to 95 parts of sulphuric acid in quantity equal to 1 to 10 per cent of the oil, allowing the asphaltum and associated impurities to settle, and then washing the oil with an aqueous solution containing about 5 per cent of sodium hydroxide and 5 per cent of sodium carbonate and then separating the purified oil from the sedimentary matter.

716,132—December 16, 1902. JOHN STEWART STEWART-WALLACE AND WILLIAM BLACKWELL COWELL. *Method of treating mineral oils or the distillates or residuals thereof.*

Claims a method of treating mineral oils consisting in placing them in a suitable vessel, supplying thereto caustic soda and permanganate of potash, heating and agitating the mixture, collecting and condensing any desired light oils that may be present in the mixture and driven off during such heating, allowing said mixture to settle in order that the impurities may separate therefrom, supplying the remaining mixture to the still and collecting the distillates.

723,368—March 24, 1903. THEODORE F. COLIN AND OTTO P. AMEND. *Process of purifying and desulphurizing crude petroleum and petroleum distillates.*

Claims the process of desulphurizing petroleum and its distillates which consists in the oxidation of the sulphur contained therein (without precipitation of the sulphur) by means of a hypochlorite in alkaline solution in the presence of an oxygen carrier or catalytic agent at ordinary or slightly elevated temperatures.

732,937—July 7, 1903. CHARLES BOOTHROY GRAHAM. *Process of refining oil.*

Claims the process of purifying oil, consisting in passing the same through a compound of lime water, pyrogallic acid, and caustic potash.

736,479—August 18, 1903. FRIEDRICH BERG. *Process of deodorizing or purifying petroleum.*

Claims an improvement in purifying or deodorizing petroleum, comprising the treatment of the oil with an alkali for several hours at a temperature considerably above 212° Fahrenheit in a closed chamber having an air outlet at the top, and condensing, within the upper end of said chamber next over the body of oil undergoing treatment, approximately all of the condensable vapors arising from the oil body and alkali during the said treatment and repeatedly converting the oil from a liquid to a vaporous or gaseous state and vice versa during the said treatment within the said upper end of the said chamber.

736,480—August 18, 1903. FRIEDRICH BERG. *Apparatus for deodorizing or purifying petroleum.*

Claims the combination, with a tank forming a vaporizing chamber having a top, a pipe extending upwardly from said top and communicating with the vapor space forming upper portion of the said chamber, and means for heating the said chamber, of two manifolds arranged within opposite sides of the said upper portion of the said chamber and extending circumferentially of the chamber near the aforesaid top, parallel pipe sections extending and establishing communication between the said manifolds and arranged a short distance apart laterally, means for conducting water into one of the said manifolds centrally between the ends of the respective manifold, means for conducting water from the other manifold centrally between the ends of the last-mentioned manifold, and means for supporting the said manifolds and the aforesaid pipe sections from the tank.

738,656—September 8, 1903. ARTHUR W. BURWELL AND LAYTON O. SHERMAN. *Process of desulphurizing crude petroleum.*

Claims the process of desulphurizing crude petroleum, which consists in distilling the petroleum, and passing the oil vapors in contact with oxides of iron and an alkaline earth metal, both of said oxides being entirely free from water.

744,720—November 24, 1903. THEODORE F. COLIN. *Process of desulphurizing sulphur-bearing petroleum.*

Claims the process of desulphurizing petroleum and its distillates which consists in treating them with an aqueous solution of iron sulphate, sodium chloride, and copper sulphate.

747,347—December 22, 1903. OTTO P. AMEND. *Process of desulphurizing oils or distillates.*

Claims the process of desulphurizing oil or distillate which consists in eliminating the sulphureted hydrogen contained therein; in neutralizing fatty and organic acids contained therein by subjecting them to the action of an alkali and then drawing off or removing the excess or settled alkali; in exposing the sulphur and sulphur compounds in the oil or distillate to the action of a soluble salt of copper in the presence of an alkali, but with the copper solution in excess of the alkali, thereby producing a hydrated copper in a neutral saline solution: in removing the excess of copper, the copper hydrosulphides, and residuum, and exposing the remaining copper and copper sulphides to the action of sulphuric acid, and in removing the acid and sludge.

747,348—December 22, 1903. OTTO P. AMEND. *Process of desulphurizing oils or distillates.*

Claims the process of desulphurizing oil or distillate which consists in eliminating sulphureted hydrogen therefrom by washing, blowing with steam or air or by both steam and air; in removing fatty and organic acids contained therein by subjecting them to the action of an alkali, in removing the alkali after agitation; in agitating the oil or distillate with a soluble salt of copper in the presence of a soluble carbonate; in removing the excess of copper salts and copper hydrosulphides thus formed and subjecting the oil or distillate to the action of sulphuric acid, then removing the acid sludge.

769,681—September 6, 1904. ALBERT C. CALKINS. *Process of treating oils.*

Claims the process or method of treating oil or other fluids which consists in confining the oil within a closed treating receptacle or tank, subjecting the oil to the action of sulphuric acid to precipitate tarry matters within the oil, withdrawing the sulphurous acid gas generated within the tank, and returning the same to and through the contents of the tank to bleach and agitate the oil.

783,916—February 28, 1905. GEORG VON WIRKNER. *Process of manufacturing pitch.*

Claims the process for obtaining pitch from tar oils and similar materials which consists in heating the same with a suitable quantity of sulphuric acid to a temperature of about 180° centigrade at least, until the sulphuric acid is decomposed and a sufficient quantity of the volatile bodies has been distilled off to leave a pitch of the desired consistency.

793,026—June 20, 1905. HENRY SPENCER BLACKMORE. *Process of separating sulphur from the sulphur containing constituents of petroleum and making hydrogen carbid.*

Claims the process of removing sulphur from petroleum containing the same, which consists in exposing sulphur containing petroleum to the action of an alkali earth metal carbid.

SUBCLASS 27.—INJECTING GASES.

10,055—September 27, 1853. WILLIAM BROWN. *Improvement in preparing paraffine oil.*

Claims the use of superheated steam in a special manner in the distillation of coal and other bituminous substances.

25,575—September 27, 1859. GEORGE M. MOWBRAY. *Improvement in processes of distilling oils from coal.*

Claims in the manufacture of coal oil and other pyrogenous oils by exposing the coal or other materials to the products of combustion generated in a separate furnace, igniting said products of combustion, previous to admitting the same into the distilling kiln, by admixture of a sufficient proportion of air to burn the oxide of carbon into carbonic acid.

27,767—April 10, 1860. LUTHER ATWOOD. *Improvement in the distillation of hydrocarbon oils.*

Claims the use of steam in preparing a hot still for the safe admission of a charge of oil.

28,448—May 29, 1860. LUTHER ATWOOD. *Improvement in the manufacture of oils obtained from coal.*

Claims the production of thin oils suitable to be manufactured into illuminating oils from the heavier parts of the crude and fixed oils and other substances within mentioned by treating them in manner substantially as hereinbefore described during one or several continuous distillations.

39,607—August 18, 1863. S. LLOYD WIEGAND. *Improvement in distilling oils and paraffine from peat and other substances.*

Claims the use of the products of the decomposition of steam by means of incandescent carbon in the separation of hydrocarbon oils and paraffine from peat or coal or other bituminous substances, whether used by themselves or in combination with superheated steam.

49,739—September 5, 1865. LEVI S. FALES. *Improved process of distilling petroleum.*

Claims the distillation of crude petroleum or other oils by heat applied above the surface through the medium of a current or currents of air circulating through the upper part of the still.

50,935—November 14, 1865; reissue 8,374—August 13, 1878. Division B. JAMES J. JOHNSTON. *Improvement in processes for evaporating liquids.*

Claims the process of obtaining a useful product from air, steam, and the vapor of hydrocarbon liquids, namely, by uniting them in a highly heated condition.

51,843—January 2, 1866. ORAZIO LUGO. *Improvement in distilling petroleum and other substances.*

This invention consists of an improvement in distillation by forcing into or through a still or stills a current of air or other suitable gaseous substance.

56,343—July 17, 1866. JAMES ADAIR AND H. W. C. TWEDDLE. *Improvement in evaporating and distilling liquids.*

Claims the mode of distilling or evaporating petroleum or other liquids by passing through or over the liquid to be distilled or evaporated heated carbonic oxide or carbonic acid.

58,113—September 18, 1866. ORAZIO LUGO. *Improvement in apparatus for distilling petroleum, etc.*

Claims the admission of air or gas into the goose neck or exit pipe of a still.

60,076—November 27, 1866. H. L. SMITH. *Improvement in treating oils, etc.*

Claims the process of treating crude petroleum, or its distillate, in a closed retort, by the introduction of steam.

60,396—December 11, 1866. ORAZIO LUGO AND T. O. L. SCHRADER. *Improved process of distilling petroleum oils and other substances.*

Claims the admission of air or gas into a still at a temperature equal to or greater than that of the oil or substance undergoing the distilling process.

86,535—February 2, 1869. CHARLES H. HALL. *Improvement in distilling hydrocarbon oils.*

Claims distilling hydrocarbon oils and other distillable liquids by steam, under pressure.

87,485—March 2, 1869. SAMUEL GIBBONS. *Improvement in the manufacture of lubricating oils from petroleum.*

Claims the preparing of petroleum or hydrocarbon oils for lubricating purposes, by reducing the gravity of the same by the direct action of steam or superheated steam upon the crude petroleum while in a still, tank, or retort.

87,658—March 9, 1869. SAMUEL GIBBONS. *Improved process of preparing petroleum to be used in lubricating wool.*

Claims an oil, or grease, made of petroleum, for the purpose of greasing wool.

99,975—February 15, 1870. HERBERT W. C. TWEDDLE. *Improvement in the manufacture of paraffine and paraffine oils.*

Claims the process of producing paraffine by an exhaustive distillation of the heavy oil at a comparatively low temperature by the use of steam in a vacuum still, with or without a fire heat, so as to drive over the paraffine vapors undecomposed.

100,874—March 15, 1870. JOSEPH B. EDWARDS. *Improvement in stills for distilling hydrocarbons.*

Claims the use of steam in the distillation of liquid hydrocarbons, in stills heated by external fire, when the steam is introduced into the still in such a manner that the lowest stratum of liquid therein will be continually removed from contact with the bottom of the still by the action of the steam, and its place supplied with fresh liquid from above.

120,349—October 24, 1871. HERBERT W. C. TWEDDLE. *Improvement in refining hydrocarbon oils.*

Claims the introduction of carbonic acid gas or other noninflammable gas into tanks or vessels containing petroleum, for the purpose of preventing the formation of explosive mixtures of hydrocarbon vapor and oxygen.

145,707—December 16, 1873. ASA W. WILKINSON. *Improvement in distilling petroleum.*

Claims the process of distilling petroleum, by injecting into and through the liquid mass contained in the still a gas or vapor which will not produce combustion, and will not enter into a deleterious combination with the product of distillation.

159,887—February 16, 1875. VICTOR G. BLOEDE. *Improvement in treating oils.*

Claims the process for reducing, distilling, or concentrating crude oils consisting of heating the oil from 212° to 500° Fahrenheit temperature, thoroughly agitating the same at such temperature, and injecting air or dry steam over the surface of the oil.

183,401—October 17, 1876. DANIEL M. LAMB. *Improvement in processes for refining petroleum and other oils.*

Claims in the art of treating oils by the agency of gas generated by the admixture of sodium chloride and sulphuric acid, the first step toward bleaching and deodorizing, which consists in generating the gas beneath the oil, and while the same is at rest, thus permitting the gas to permeate the oil and act upon the entire body.

194,275—August 14, 1877. REUBEN D. TURNER. *Improvement in processes and apparatus for cleaning and purifying oil, grease, etc.*

Claims the process for refining, purifying, and deodorizing oil, grease, or fatty matter by mingling the same with water, and violently agitating the liquid mass in a close vessel, a current or currents of air being forced into and through the liquids at the same time, and heat being applied during the first part of the operation.

212,914—March 4, 1879. HIRAM B. EVEREST. *Improvement in the distillation of oils.*

Claims the mode of preventing the scorching or burning of residual heavy oils in stills, which consists in injecting steam into the still after the distilling operation has been discontinued, and after the fires have been drawn, thereby cooling and agitating the residual oil by the steam simultaneously with the cooling of the surface of the still.

222,408—December 9, 1879. EDWARD C. KATTEL. *Improvement in refining petroleum oils.*

Claims the process of deodorizing an oleaginous substance, which consists in subjecting it to the action of superheated steam and atmospheric air introduced below the surface of the mass, the oleaginous substance being maintained at a temperature between 212° Fahrenheit and its point of vaporizing to prevent condensation of steam.

240,936—May 3, 1881. WILLIAM G. WARDEN. *Apparatus for and process of cooling and refining oil.*

Claims the process of cooling and refining oil, which consists in agitating it with a blast of air, which air has been previously cooled and dried by being passed successively, first, in contact with a cooled surface; second, through a bath of sulphuric acid; and, third, in contact with a cooled surface.

265,462—October 3, 1882. CHARLES J. TAGLIABUE. *Apparatus for and process of distilling petroleum.*

Claims the process of distilling petroleum, which consists, first, in heating the oil, then breaking up the same by successive operations of a steam atomizer, and of a jet or jets of hydrogen gas or hot air, mingling it with vapor which has not been submitted to the process of atomization, and condensing the mixed vapors.

306,965—October 21, 1884. MARVIN J. SEYMOUR. *Method of heating petroleum oil.*

Claims the method of precipitating water and other impurities in petroleum oil consisting, essentially, in heating natural gas by connecting one or more gas jets or burners with the gas supply pipe and arranging said burners in close proximity to said supply pipe, whereby the gas is heated, and then discharging the heated gas into the cold oil.

311,543—February 3, 1885. EBENEZER W. STRAIN. *Process of refining, reducing, and separating hydrocarbon oils.*

Claims the method of refining, reducing, and separating oil by a continuous process, consisting, first, in subjecting it to the action of heat under pressure and while in a state of transit, whereby it is raised to such a sufficient degree of temperature as to cause the separation of the volatile gases from the heavier oils on removal of the pressure; second, in spraying the heated oil in an expansion chamber, and, third, in trapping the oil which is condensed in the expansion chamber; and conveying the uncondensed vapors through surface condensers, where the vapors of different degrees of gravity are, at the points of condensation, trapped, and thereby separated.

339,545—April 6, 1886. JAMES B. GRANT. *Process of refining petroleum.*

Claims the process of refining petroleum and analogous oils, which consists in introducing the oil and steam together in an atomized condition into a heated chamber, and removing by means of a vacuum pump substantially the whole of the mixed vapor of oil and steam, without sensible condensation in the retort, into a condensing chamber.

372,672—November 8, 1887. THURSTON GORDON HALL. *Process of refining hydrocarbon oil.*

Claims the process of manufacturing hydrocarbon oil, which consists in subjecting the mingled vapors of a hydrocarbon oil and steam to large converting surfaces of granite or equivalent material heated to a temperature above 430° Fahrenheit by passing said vapors through and in contact with the converting material, and in subsequently condensing the same.

379,090—March 6, 1888. ROBERT J. WILSON. *Process of refining oil.*

Claims the process of refining crude oil and utilizing the waste products, which consists in subjecting said oil to the action of intensely heated air admitted directly to the body of the oil, thereby volatilizing the latter, then separating the greater portion of the volatilized oil from the air, and finally conducting off the air and uncondensed gases to be utilized for heating or illuminating purposes.

419,931—January 21, 1890. JAMES DEWAR AND BOVERTON REDWOOD. *Process of distilling mineral oils and like products.*

Claims the method of distilling mineral oils and like products, which consists in both vaporizing them and condensing the generated vapor under a regulated pressure of air or gas.

435,198—August 26, 1890. ROBERT ALEXANDER. *Process of refining crude asphaltum.*

Claims the process of refining crude asphaltum and obtaining an improved product therefrom, which consists in desiccating the crude asphaltum at a low temperature, recovering the condensable oils given off during desiccation, and subsequently returning said oils to the desiccated material.

444,202—January 6, 1891. ALLAN MASON. *Process of distilling oil.*

Claims the process of continuous fractional distillation of petroleum and other analogous oils in repeated steps of continuous succession and increased heat in which the previously unvaporized oil is successively treated, which consists of introducing the oil and steam together and causing the instantaneous junction of the same collectively in an atomized condition in the several heated chambers successively, instantaneously separating in the several chambers the portions vaporable by the respective temperatures, accelerating the movement of both the vaporized and unvaporized oil along the retort chambers to their respective exit passages by the impulse of the steam jets, exposing the vaporized portions all alike to the same conditions of time and heat in the respective chambers, similarly exposing all the unvaporized portions therein, and likewise and instantaneously removing both the vaporized and unvaporized portions to the condensers and successive sections of the retort, respectively, so that all portions of each have like exposure to the heat and steam in the respective chambers.

452,578—May 19, 1891. CHARLES C. MENGEL, Sr. *Process of refining crude petroleum.*

Claims the process of refining Lima petroleum, which consists in introducing into the vapors arising from the still during the process of distillation natural gas in a heated condition equal to the temperature of the oil vapors, passing the mixture through pipes, boxes, or other suitable conduits of sufficient lengths, and superheated to prevent condensation, and allowing the necessary chemical action to take place, and finally conducting them into the condensers.

452,764—May 19, 1891. FREDERICK SALATHE. *Hydrocarbon product.*

Claims as a new manufacture, the hydrocarbon product, member of the $C_{10}H_{16}$ series, the same being a solid material, with a specific gravity of about 1.028, tough and of a glossy jet black color, flexible and somewhat plastic at ordinary temperature, soluble in naphtha, turpentine, and other solvents before named, capable of withstanding a temperature of 600° Fahrenheit, resisting acids and alkalies, excepting concentrated nitric and concentrated sulphuric acids, and amalgamating with rubber.

470,911—March 15, 1892. JESSE A. DUBBS. *Desulphurizing oil.*

Claims the process of desulphurizing crude Lima and other mineral oils containing a large percentage of sulphur, which consists in forcing through the same before distillation a gas rich in hydrogen, whereby the sulphur in the oil will unite with the hydrogen of the gas passing off in the form of incondensable sulphureted hydrogen and preventing the formation of indestructible and deleterious carbon sulphides.

471,963—March 29, 1892. THOMAS DRAKE. *Process of refining oils.*

Claims the method of treating liquid mineral hydrocarbon, such as petroleum, which consists in first concentrating the oil, then forcing chlorine gas through it until its specific gravity has increased to between 0.900° and 1.05°, and finally correcting the acidity of the product.

486,406—November 15, 1892. JOHN B. HUSTON. *Process of removing sulphurous compound from oils.*

Claims the process of removing sulphurous compounds from oil, consisting of, first, vaporizing the oil; second, superheating the oil vapors conjointly with steam, free from the presence of oil or other liquid, to the temperature at which the sulphurous compounds are decomposed from the remaining portion of the oil vapors, so as to chemically unite with the hydrogen of the steam; third, separating the resultant vapors.

498,588—May 30, 1893. CHARLES TOPPAN. *Treating oils.*

Claims mineral or vegetable oils combined with the gases evolved from the admixture of chloride of sodium, metallic zinc, and sulphuric acid.

510,672—December 12, 1893. EDWARD G. BROWN, OSWALD N. CAMMANN, AND OLIVER WILLCOX. *Process of obtaining sweet residual petroleum products.*

Claims the continuous process of obtaining a refined and sweetened residual product of petroleum, consisting in, first, subjecting petroleum to distillation by the agency of heat externally applied; next, while still so heated causing the passage through it of saturated steam, and, finally, while still heated causing the passage through it of air.

524,130—August 7, 1894. FRANCIS X. BYERLEY. *Manufacture of asphalt, etc., from petroleum.*

Claims the process of making asphaltic products, by prolonged exposure of petroleum tar to a pitch forming noncoking temperature in a still, with agitation of said tar, and exposure of the same to air.

547,329—October 1, 1895. FRANCIS X. BYERLEY. *Process of refining Lima oil.*

Claims the process of obtaining purified distillates from Ohio or Lima oil, or, in other words, from oil containing the impurities which are characteristic of the petroleum from the vicinity of Lima, Ohio, and which resist removal by the sulphuric acid and alkali, or so-called Pennsylvania treatment, the said process consisting in distilling such oil at a low temperature with the aid of an exhaustion of the vapors, and during such distillation subjecting the said impurities to the action of air in volume sufficient to effect a substantial conversion thereof, as indicated by the loss of the characteristic malodor of the aforesaid oil.

564,341—July 21, 1896. FREDERICK SALATHE. *Hydrocarbon product.*

Claims the new composition of matter set forth, consisting of a conjugated oxy compound of bitumen and oxygen, having a melting point lying between 200° and 300° Fahrenheit, which has a higher specific gravity and a higher melting point and is less soluble in amylic alcohol and petroleum naphthas and which, when melted, is more penetrating for saturating woody fiber than the bitumen from which it is formed and also than the corresponding sulphurized product, when in like condition and which under oxidation by concentrated nitric acid produces nitro products together with an organic acid identified with styphnic acid.

579,360—March 23, 1897. FRANK L. DYER. *Process of distilling volatile liquids.*

Claims in the art of distilling volatile liquids, the improvement which consists in maintaining the liquid to be distilled at a high vacuum, in injecting expanded and reheated steam into the liquid, whereby active distillation is effected and in maintaining the vacuum by the removal of the vaporized distillates as fast as formed.

664,813—December 25, 1900. THOMAS MACALPINE. *Process of distilling and refining oils.*

Claims the process of treating oils, which consists in heating said oils in a closed vessel, maintaining a partial vacuum in said vessel, and introducing into said vessel steam below 212° in temperature.

694,621—March 4, 1902. JESSE A. DUBBS. *Distilling oil.*

Claims as an improvement in the art of treating oils the method which consists in forcing air through the oil while the latter is maintained at a vaporizing temperature and then subjecting the distillate while heated to the action of air.

SUBCLASS 28.—RESIDUUM.

24,952—August 2, 1859. HENRY PEMBERTON. *Improvement in refining coal oils.*

Claims recovering the sulphuric acid used from the residuum resulting from the process of the purification of coal oils with sulphuric acid by treating the residuum with water heated or caused to boil by steam or otherwise.

32,705—July 2, 1861. JOSHUA MERRILL. *Improvement in the manufacture of hydrocarbon oils.*

Claims the improvement in the process of purifying hydrocarbon oils by treating the first distillate with acid residues.

37,918—March 17, 1863. ADOLPH MILLOCHAU. *Improvement in preparing a paint oil from the petroleum residuum.*

Claims the process of manufacturing oil adapted to mixing with paints and colors from the acid residuum in the refining of petroleum or coal oils.

38,641—May 19, 1863. ADOLPH MILLOCHAU. *Improved process of preparing oil as a substitute for linseed oil.*

This invention consists in combining the process of further distillation of the paint oil, either with or without the removal of the odor thereof, accompanied by the provision for allowing the liquid to settle properly with the washing the acid residuum and then treating it with alkali and permitting the product to settle after each of these operations.

41,085—January 5, 1864. ADOLPH MILLOCHAU. *Improvement in obtaining useful products from the tarry residuum of petroleum.*

Claims producing an oil grease from petroleum or coal oil tarry residuum by the process consisting in treating said residuum first with benzine or light oil, and then with an acid, and in removing the acid by means of an alkali and water.

59,531—November 6, 1866. MICHAEL BARRETT. *Improved process for the recovery and purification of sulphuric acid used in refining petroleum, etc.*

Claims the recovery, purification, and revivification of the sulphuric acid spent and deteriorated in the process of refining petroleum, coal, and shale oils by means of oxygen gas in the nascent state, by whatever means developed or obtained.

96,097—October 26, 1869. ALONZO FARRAR. *Improved process of obtaining useful oil from the acid residuum of petroleum.*

This consists in treating the residuum with caustic soda, lime, and water successively.

100,876—March 15, 1870. ALONZO FARRAR. *Improved process of treating acid residuum from oil refineries.*

This process involves a distillation of the lighter oils by heat, an incorporation of chlorine or chloride of lime with the residuum, and a subsequent heating and agitating of it until the desired effect results.

106,915—August 30, 1870. GERVAIS CHEVRIER. *Improvement in treating acid tars from coal.*

Claims the treatment of acid tars and oils with chloride of sodium or chloride of ammonium, whereby the residuum from distillation of coal oils may be purified and the acids utilized.

107,734—September 27, 1870. WILLIAM SPEARS. *Improvement in the manufacture of hydrocarbon oils.*

Claims an illuminating oil manufactured by distilling a chemical combination formed of benzine and tar.

110,364—December 20, 1870. CHRISTOPHER HOULKER. *Improvement in purifying oils which have been used in lubricating machinery.*

Claims the process for purifying or cleaning refuse petroleum lubricating oil that has been used for oiling shafting or other machinery.

178,061—May 30, 1876. WALTER P. JENNEY. *Improvement in obtaining a resinous substance from purified sludge oil.*

Claims the process for producing from sludge oil a substance or manufacture possessing the properties or qualities by combining the oxygen of the air with the sludge oil with the aid and assistance of a moderate degree of heat.

178,164—May 30, 1876. WALTER P. JENNEY. *Improvement in resinous substances.*

Claims the new manufacture or substance derived from sludge oil by a process of oxygenation, and possessing the substantial properties, among which are that it is a solid substance of greater or less consistency or hardness, has a resinous appearance, and is not acted upon by the specified alkalies.

189,402—April 10, 1877. HERBERT W. C. TWEDDLE. *Improvement in petroleum products and methods of obtaining the same.*

Claims the process for obtaining a new product from petroleum consisting in lixiviating the orange colored resinous oily product obtained toward the close of the distillation of tar residuum, and recovering the precipitate.

190,762—May 15, 1877. WALTER P. JENNEY. *Improvement in processes of treating sludge and sludge oil.*

Claims the process of manufacture for producing from sludge or sludge oil the substance possessing the properties or qualities described, by oxidizing the sludge oil by sulphuric acid.

230,171—July 20, 1880. HENRY BOWER. *Process of and apparatus for treating residuum from petroleum refineries.*

Claims the process of recovering sulphuric acid, oily ingredients suitable for redistillation, and solid carbon from the sludge acid residuum of petroleum refineries, which consists in subjecting the constituents of sludge acid to the successive operations of washing, mechanical separation, concentration, and distillation, and simultaneously condensing the waste vapors and discharging the products of condensation beneath the surface of running water.

488,628—December 27, 1892. HANS A. FRASCH. *Method or process of treating sludge.*

Claims the process of recovering and concentrating the sulphuric acid of sludge, which consists in leaching the sludge with water, the temperature of which is below the melting point of heavy sludge and the volatilizing point of light sludge, and then passing the watery product from one tank through the sludge of a series of tanks in succession, the accumulating solution being carried from tank to tank until the desired concentration or density of acid is obtained.

618,307—January 24, 1899. AUGUST WENDTLAND. *Process of removing green color from paraffine.*

Claims a process for removing the green color from petroleum residues which have been treated with sulphuric acid, which consists in treating the same with a soap composed of fatty acid and an alkaline solution, allowing the soapy and oily matters to separate, treating the oily portion with barium chloride solution, and filtering such oily portion through boneblack which has been impregnated with alcohol.

779,197—January 3, 1905. HORACE W. ASH. *Distillation and treatment of crude bituminous material.*

Claims the method of distilling and inspissating crude bituminous material comprising the subjection of the said material in a still to a distilling heat and depositing in the distilling material an impalpable powder.

779,198—January 3, 1905. HORACE W. ASH. *Method of distilling crude bituminous material.*

Claims the method of distilling and treating crude bituminous material consisting in subjecting the material in a still to the action of exterior heat upon the still and at the same time introducing into the still, under pressure, the products of combustion which have passed the exterior of the still.

SUBCLASS 29.—WASHING AND FILTERING.

36,488—September 16, 1862. JOHN TAGLIABUE. *Improved apparatus for testing the explosiveness of coal oils or petroleum.*

Claims the employment of holes in a water bath in connection with a mark for adjusting the height of the oil in the oil cup used for testing the flashing point.

36,826—October 28, 1862. G. TAGLIABUE. *Improvements in apparatus for testing the flashing and ignition point of oils.*

The claims cover a number of minor details which serve to increase the facility and accuracy in making the tests.

44,519—October 4, 1864. WILLIAM PORTER DOWNER. *Refining petroleum and other oils.*

Claims the use of a rotary hermetically-closed vessel for mixing petroleum and other oils with acids.

49,777—September 5, 1865. ADOLPH MILLOCHAU. *Improved instrument for testing petroleum.*

Claims an oil receptacle containing a wick tube or burner to heat and inflame the petroleum or other oil in combination with a thermometer introduced into such receptacle.

54,414—May 1, 1866. WILLIAM H. SANGSTER. *Improvement in apparatus for refining petroleum.*

This invention consists in placing a partition within the tank or vessel for holding the chemicals, which is so arranged as to separate it into two parts and leave an opening near the bottom, through which the oil is made to flow in its passage through the chemical solution from one division to the other, during the process of refining or washing; also, in combination therewith, of a perforated plate or its equivalent, for the purpose of increasing the distance of the flow of oil through the chemical solution.

57,285—August 21, 1866. D. H. BURKET AND J. C. GRAY. *Improved apparatus for treating petroleum.*

The object of this invention is to produce lubricating oil from petroleum in a crude state by means of simple mechanical combinations to agitate the oil, assisted by the introduction of steam or heated liquid into the oil while it is being agitated. By these means the gravity of the crude petroleum is reduced, which accomplishes the desired result.

60,585—December 18, 1866. HAMILTON L. SMITH. *Improvement in refining hydrocarbon.*

Claims a charcoal filter in combination with a receiver fan, heater, and coiled pipe.

61,125—January 8, 1867. P. H. VANDERWEYDE, M. D. *Improvement in refining petroleum and lubricating oils.*

Claims the heating of the heavy petroleum in a steam coil, thus preparing it for the filter, and in the same time saving and condensing the vapors arising, namely, gasoline, naphtha, and benzine.

62,798—March 12, 1867. W. H. YPUNG. *Improvement in preparing petroleum for lubricating.*

Claims the cleansing of oil by means of an underlying body of heated water.

63,051—March 19, 1867. FLEURY HUOT AND JOHN ROGERS. *Improvement in refining petroleum, etc.*

Claims separating the boneblack and impurities from the oil by filtering the same through a centrifugal filter.

63,051—March 19, 1867; reissue 3,145—October 6, 1868. FLEURY HUOT. *Improvement in refining petroleum.*

Claims the process set forth of purifying petroleum and other liquids by mixing with the same boneblack or other carbonaceous material, and then separating the said liquid from the carbonaceous substances by a centrifugal filter.

68,869—September 10, 1867. FORDYCE SYLVESTER. *Improvement in refining petroleum.*

Claims refining and purifying petroleum oil by passing it through hot water.

90,392—May 25, 1869. LUCIEN M. RICE AND SIDNEY E. ADAMS. *Improved apparatus for treating hydrocarbon oils.*

This invention consists in aerating and refining the fluid operated upon by projecting it upward in fine jets, and allowing it to fall in drops into a proper receptacle, by means of which the more volatile portion is separated, and passes off into the atmosphere, and a higher "fire test" is given to the oil and the machinery by which this is effected.

104,798—June 28, 1870. PETER H. VANDER WEYDE. *Improved instrument for testing oils.*

Claims the vaporizing of hydrocarbon oil or fluids in a transparent closed chamber, having its only vent sealed by water, in such manner that the vapors of such fluids will be isolated, and the temperature of "flashing point" shown.

109,772—November 29, 1870. WILLIAM M. SLOANE. *Improvement in purifying and refining oils.*

Claims the method of purifying oils by agitating with any deodorizing agent in a close vessel, under the action and pressure of steam.

110,638—January 3, 1871. RICHARD EATON. *Improvement in refining petroleum.*

Claims the art of removing earthy particles and other impurities from crude petroleum oil by the washing action of water.

133,598—December 3, 1872. EMIL SCHALK. *Improvement in treating petroleum.*

Claims a continuous process of treating and washing distilled petroleum.

154,430—August 25, 1874. REUBEN D. TURNER. *Improvement in apparatus for refining petroleum.*

This invention consists in the combination of a perforated steam coil with steam and oil atomizers arranged within a refining chamber, and connected with an outside oil heating vessel or tube, whereby all the obnoxious odors and explosive or "flashing" principles of the oil are absorbed and the oil generally improved for illuminating and other purposes.

174,921—March 21, 1876. CHARLES L. MOREHOUSE. *Improvement in processes and apparatus for manufacturing illuminating oils.*

Claims the process for refining hydrocarbon oils, consisting in treating them with steam, so as to remove the lighter portions, washing with caustic alkalies, and filtering with a warm filter.

297,603—April 29, 1884. JOHN B. HUSTON. *Apparatus for improving the fire test of petroleum and for bleaching other oils.*

This apparatus consists of a cylinder or vessel having a series of chambers, one above the other, the floors of which are perforated, with the exception of the lowest one. By the side of said vessel is placed a large air pipe having communications with the upper part of the said chambers. Within said pipe a steam pipe and an oil pipe are placed, the steam pipe having connections with the lower part of said chambers, while the oil pipe leads up to and communicates with a low chamber in the top of the aforesaid chambered vessel. The steam pipe warms the air in the air pipe and this warms the oil before they enter the said vessel. The branches of the steam pipe are provided with stopcocks. Outlet pipes are provided to each chamber, opposite to the steam and air pipes, for the escape of the vapors. This comprises the arrangement for treatment of petroleum products. For the bleaching purpose a box for containing the bleaching material is placed near the base of the said air pipe, to which it is connected by a short pipe. On opposite side of said box is placed an air blower for the purpose of forcing the fumes or gases from the said box into the aforesaid chambered vessel. From the top of the said vessel a pipe leads back to said blower. This is for returning the said bleaching gases to the blower and using them repeatedly.

299,611—June 3, 1884. LESLIE A. BAKER. *Process of refining petroleum.*

Claims a process of separating crude petroleum into its light and heavy constituents, consisting in mixing with the crude petroleum a cold medium, and thereby reducing its temperature, and then filtering the same.

313,514—March 10, 1885. JAMES W. NORTON AND FRANKLIN H. ROUSE. *Apparatus for removing paraffine from oil tanks.*

Claims the method of removing paraffine, sedimentary, or B. S. oil from the bottom of oil tanks, consisting, first, in forcing steam, hot air, or hot water through pipes to the bottom of the tank and beneath the oil in the same to liquefy the sedimentary deposits, and finally causing the withdrawal of the liquefied solution up through the said pipes and out from the tank to a suitable receptacle without removing the oil.

359,357—March 15, 1887. EDWARD D. KENDALL. *Process of and apparatus for refining hydrocarbon.*

Claims the process of treating distillate with sulphuric acid, which consists in forcing together regulated quantities of the acid and the distillate, and causing them to pass together under pressure through a pipe or tube provided with stationary obstructions, whereby they are thoroughly mingled by the force of the liquid itself.

363,432—May 24, 1887. LEVI STEVENS. *Process of distilling petroleum.*

Claims the process of vaporizing petroleum by injecting it into hot water heated above 212° Fahrenheit under pressure in a closed vessel, and conducting the vapors therefrom.

400,634—April 2, 1889. FRANCIS M. F. CAZIN. *Apparatus for refining petroleum.*

Claims the combination, with an upright vessel having a water supply pipe and an oil supply pipe leading to its lower part, of a water overflow pipe leading from a point between the ends of the vessel, first downward and thence upward to a point near the top of the vessel, thus forming a loop to permit the oil entering the pipe with the water to escape back to the vessel by reason of its lighter specific gravity, oil distributers arranged in the lower part of the vessel, whereby the entering oil is finely divided or diffused prior to rising through the water, and an oil overflow pipe at about the level of the water overflow.

405,047—June 11, 1889. THOMAS JEFFERSON NEWSOME. *Fluid separator.*

Claims a fluid separator consisting of a vessel or tank provided with a horizontal diaphragm forming an upper and lower chamber, a central tube communicating at its upper end with the upper chamber, its lower end extended within the lower chamber near the bottom thereof, a discharge pipe connected with the lower chamber above the lower end of the central tube, a discharge pipe connected with the lower portion of the upper chamber, and a funnel or tube adapted to enter the upper end of the central tube and projected therein to a point below the diaphragm.

613,723—November 8, 1898. MARTIN SHIVELY. *Method of and apparatus for purifying crude oils.*

Claims the method of purifying crude petroleum and other oils in bulk, consisting of delivering jets of hot water tangentially upon the surface of the oil contained in a tank or receptacle to cause the oil to rotate, then allowing the hot water to pass down through the rotating body of oil to simultaneously heat it and absorb and precipitate the impurities partly separated by the rotary movement of the oil.

672,888—April 30, 1901. CAL M. AUKERMAN. *Purifying system for crude petroleum.*

Claims in an oil purifying system, the combination with a receiving tank of a heating coil connected at one end to the lower portion of the tank by branch pipes, one branch tapping the tank below the normal water level, and another branch above the normal sediment level, the opposite end of the coil being connected with the top portion of the tank by a pipe having its opening within the tank below the normal oil level.

681,170—August 20, 1901. CHARLES R. HUDSON. *Clarifying apparatus.*

Claims in an apparatus for clarifying oil, an oil tank, a heater, a pipe extended from said heater over the oil tank, a column nozzle connecting with said pipe, a spray nozzle connecting with said pipe, and a pipe leading from the lower portion of the tank to the heater.

741,517—October 13, 1903. THOMAS MACALPINE. *Refining mineral oils.*

Claims in the process of refining mineral oil, whether crude oil or distillates thereof, the step which consists in subjecting said oil for a considerable time to the action of a solution composed of salt and carbonate of soda, said oil being kept in a state of subdivision during said time.

CLASS 73.—MEASURING INSTRUMENTS.

SUBCLASS 50.—FLUIDS.

35,184—May 6, 1862. HORACE J. SMITH AND WOODRUFF JONES. *Improvement in apparatus for testing coal oils and other mixed liquids.*

Claims determining the amount of volatile inflammable matter in compound liquids, by means of a thermometer and a flame, the thermometer being applied to the liquid while the heat is imparted to the latter, and the vapor generated by the heat being directed to the flame.

38,427—May 5, 1863. GIUSEPPE TAGLIABUE. *Improved instrument for ascertaining the amount of water, etc., in barrels of oil, etc.*

Claims a tube constructed of metal and glass with valves at top and bottom acted on by one rod, and opening and closing together, and a graduated scale on the glass sides of the tube.

56,107—July 3, 1866. GEORGE E. SHAW. *Improved carbon oil fire tester.*

Claims the water bath with a double casing and a pipe for the purpose of obtaining heat from the bottom only.

61,572—January 29, 1867. GEORGE E. SHAW. *Improved fire test torch.*

Claims the torch or lamp pivoted, suspended, or hinged to a clamp, or to a piece of a fire tester for carbon oil, so that it can be made to occupy either the vertical position or the horizontal position represented or any other position between the same.

91,843—June 29, 1869. HENRY M. HARTSHORN. *Improved instrument for testing the inflammability of illuminating oils.*

Claims a tight vessel, filled with water or other fluid, with a cavity or depression, holding the oil, forming the top of the vessel, and,

The combination of the stem of the thermometer with the tube, for the purpose of forming the handle.

127,259—May 28, 1872. PETHUEL MILLSPAUGH. *Improvement in testing burning fluids.*

Claims in combination with an instrument for testing oils or burning fluids a transparent cylinder or its equivalent for containing the fluid to be tested, and in which the thermometer is submerged.

139,654—June 10, 1873. JOHN B. BLAIR. *Improvement in apparatus for testing hydrocarbon oils.*

Claims a testing apparatus, consisting of a bottle with closed tube and a bottle with open tube in connection with a graduated support, all arranged, adapted, and operating as set forth.

152,855—July 7, 1874. STEPHEN S. MANN AND CHARLES B. MANN. *Improvement in devices for illustrating lamp explosions.*

Claims a device for illustrating lamp explosions, consisting of a cup or holder for attachment to the lamp bowl, and a detachable part that is held in the cup by means of frictional contact.

165,612—July 13, 1875. JOHN PONTON. *Improvement in automatic vapor tests for hydrocarbons.*

Claims the method or process of determining the relative temperatures at which hydrocarbons will vaporize, by conducting the vaporized hydrocarbon to the flame of a lamp, by which they are exploded, and indicating the temperature at the time of the explosion by a registering device.

197,197—November 13, 1877. FEARGUS B. SQUIRE. *Improvement in apparatus for testing the igniting temperature of hydrocarbon fluids.*

Claims in an apparatus for ascertaining the igniting temperature of hydrocarbon fluid, the combination of a fluid holding reservoir, a vertically adjustable flame holding device, and a thermometer graduated from the upper part of the bulb into equal spaces, independently of the thermometrical scale, to indicate the depth of its immersion in the said fluid, and for the purpose of adjusting the igniting flame to a required distance above the surface of the same.

204,235—May 28, 1878. STEPHEN S. MANN. *Improvement in devices for testing illuminating fluids.*

Claims in an oil testing apparatus, the combination, with an oil receiver, provided with a tube and a valve to be closed by pressure from within, of a projectile, made of any suitable material admitting of slight compression.

218,066—July 29, 1879. GEORGE M. SAYBOLT. *Improvement in electric oil testers.*

Claims in combination with the cup and reservoir of an oil fire tester, an electrical apparatus so arranged that an electrical spark from the apparatus flashes the vapor of the oil, whereby the fire test of the latter is determined.

221,421—November 11, 1879. THOMAS DE WITT PINCKNEY. *Improvement in kerosene oil testers.*

Claims a thermometrical device for ascertaining the flashing point of kerosene oil, which consists of a transparent graduated tube, provided with a bulb, having a cavity or recess in its upper part.

226,187—April 6, 1880. FRANCIS S. PEASE. *Apparatus for testing oil by electricity.*

Claims one or more electrical poles, having switches arranged on a movable and adjustable bridge, in combination with an oil bath of an oil testing apparatus.

240,365—April 19, 1881. ALEX BERNSTEIN. *Apparatus for testing illuminating fluids.*

Claims in an apparatus for testing the inflammability of oils, the combination, with an oil receptacle or vessel, provided with a fixed torch, a wick pipe beneath it, and a thermometer, of a hydrostatic tube, whereby the induced vapors are ejected at an ascertained temperature and ignited by the fixed torch and the ignition communicated to the wick.

245,568—August 9, 1881. GEORGE M. SAYBOLT. *Apparatus for testing hydrocarbon fluids.*

Claims an apparatus for testing hydrocarbon fluids or for finding their inflammable degree of temperature, consisting of a suitable bath, an oil vessel or cup, and a cap or cover for mechanically compressing the generated vapor at a certain point to eject it to an igniting torch.

309,718—December 23, 1884. CHARLES S. HIGGINS. *Apparatus for testing tallow, etc.*

Claims in an apparatus for testing tallow, the combination of the vessel having double walls and a space between them filled with nonconducting material, and provided with an inspection opening, and the double-walled cover, also filled with nonconducting material, with the glass receptacle for the tallow, placed inside the double-walled vessel.

431,795—July 8, 1890. FREELING W. ARVINE. *Apparatus for testing the burning qualities of oil.*

Claims the combination, in an instrument for testing the burning quality of oil, of a lamp-poising support, a marking point carried by said support, and a movable card holder.

774,341—November 8, 1904. FRANK N. SPELLER. *Recording calorimeter for gas.*

Claims in a device for measuring the heating value of gases, the combination of a combustion chamber, gas and air inlets thereto, means for maintaining constant pressure in said combustion chamber at all temperatures therein, and means for measuring the temperature in said chamber.

788,250—April 25, 1905. FERNAND A. COURTOIS. *Flash tester.*

Claims a flash tester comprising a support, a heater arranged underneath the support, a flue on the support, a test cup removably placed in the flue and having a trough around its upper portion, a burner tip for extending over the test cup, and a thermometer support.

POWER EMPLOYED IN MANUFACTURES

POWER EMPLOYED IN MANUFACTURES.[1]

By THOMAS COMMERFORD MARTIN, Expert Special Agent.

The total horsepower reported at the census of 1905 showed an increase of more than 40 per cent over that reported in 1900. The number of establishments reporting this power was less than 1 per cent greater than the number in 1900. This small increase is not wholly accounted for by the fact that the average horsepower per establishment has increased, but in part by the impossibility of eliminating from the statistics for 1900 all the power reported by the hand trades and neighborhood industries. The census of 1905 was one of factory industries only; that of 1900 was for factory industries and hand trades and neighborhood industries as well. It has not been practicable to separate from these latter industries any power except that of custom gristmills, custom sawmills, and cotton ginneries. But as a comparatively small amount of power is used in the other hand trades and neighborhood industries, the inclusion has little effect except upon the number of establishments reporting.

A comparative summary by kind and amount of power, for the censuses from 1870 to 1905, with percentages is as follows:

TABLE 1.—COMPARATIVE SUMMARY, WITH PER CENT OF INCREASE: 1870 TO 1905.

[For 1900 the number of establishments reporting power and the horsepower include the hand trades and neighborhood industries, except custom gristmills, custom sawmills, and cotton ginning. Prior to 1900 the total number of establishments, the number reporting power, and the horsepower include all hand trades and neighborhood industries.]

	CENSUS.					PER CENT OF INCREASE.			
	1905	1900	1890	1880	1870	1900 to 1905	1890 to 1900	1880 to 1890	1870 to 1880
Number of establishments	216,262	207,562	355,415	253,852	252,148	4.2	[1]41.6	40.0	0.7
Number of establishments reporting power	134,544	133,456	100,735	85,923	(2)	0.8	32.5	17.2	....
Total horsepower	14,641,544	10,409,625	5,954,655	3,410,837	2,346,142	40.7	74.8	74.6	45.4
Average horsepower per establishment	108.8	78.0	59.1	39.7	[3]9.3	39.5	32.0	48.9	326.9
Owned—									
Engines—									
Steam—									
Number	127,425	130,754	91,410	56,483	(2)	[1]2.5	43.0	61.8	....
Horsepower	10,828,111	8,140,533	4,581,595	2,185,458	1,215,711	33.0	77.7	109.6	79.8
Per cent of total horsepower	73.9	78.2	76.9	64.1	51.8	....	....	....	....
Gas and gasoline—									
Number	21,525	14,334	(2)	(2)	(2)	50.2	....	....	....
Horsepower	289,514	134,742	8,930	(2)	(2)	114.9	1,408.9	....	....
Per cent of total horsepower	2.0	1.3	0.1	....	....	....	....	....	....
Water wheels[4]—									
Number	20,996	23,104	39,008	55,404	(2)	[1]9.1	[1]40.8	[1]29.6	....
Horsepower	1,647,969	1,454,229	1,255,206	1,225,379	1,130,431	13.3	15.9	2.4	8.4
Per cent of total horsepower	11.3	14.0	21.1	35.9	48.2	....	....	....	....
Electric motors—									
Number	73,120	16,902	(2)	(2)	(2)	332.6	....	....	....
Horsepower	1,150,891	310,661	15,569	(2)	(2)	270.5	1,895.4	....	....
Per cent of total horsepower	7.9	3.0	0.3	....	....	....	....	....	....
Other power, horsepower	92,154	49,985	4,784	(2)	(2)	84.4	944.8	....	....
Per cent of total horsepower	0.6	0.5	0.1	....	....	....	....	....	....
Rented, total	632,905	319,475	88,571	(2)	(2)	98.1	260.7	....	....
Per cent of total horsepower	4.3	3.0	1.5	....	....	....	....	....	....
Electric horsepower	441,592	182,562	(2)	(2)	(2)	141.9	....	....	....
Other kind, horsepower	191,313	136,913	88,571	(2)	(2)	39.7	....	....	....

[1] Decrease.
[2] Not reported.
[3] Average for all establishments enumerated, whether reporting or not reporting power.
[4] Includes 1,398 water motors with 5,934 horsepower for 1905.

The actual increase in the average horsepower per establishment was largest between 1900 and 1905. The 1870 average is not comparable with any other, as it is an average for all establishments whether reporting or not reporting power. Electric horsepower, although showing the largest percentage of increase, with gas and gasoline following, yields to steam in absolute increase. As at the censuses of 1890 and 1900, steam-power forms approximately three-fourths of the horsepower of all kinds reported, although electricity and

[1] Reference should be made to Tables 2, 12, 13, and 14 in Manufactures, Part I, 1905, for the detailed and comparative statistics concerning motive power, by states and territories, and by specified industries and groups of industries, and for industries showing 50,000 horsepower, and over, by states and territories and to various tables and the text relating thereto in Chapter X of the same volume.

gas and gasoline are continually reducing the proportion. Waterpower, while increasing absolutely, is diminishing in comparison with other kinds of power. When electric power is generated by the manufacturer the horsepower of the motors is a duplication, and allowance should be made for this fact in accepting the statistics.

In Table 1 the statistics of power for 11,474 establishments that were engaged in industries excluded from the census of 1905 are included for the census of 1900. These establishments used a total of 157,125 horsepower. Exclusive of rented power the steam horsepower reported in 1900, according to these revised figures, was 8,026,022; the water horsepower, 1,449,460; and the electric horsepower, 308,439—the increase in these particulars, as shown at the census for 1905, being 34.9, 13.7, and 273.1 per cent, respectively.

Consideration must also be given to the power reported by idle establishments. Table 2 compares the kind and amount of power in such establishments for the censuses of 1900 and 1905. In this table the totals for 1900 have been reduced by the exclusion, so far as possible, of the figures for establishments of the character omitted from the census of 1905.

TABLE 2.—*Power in idle establishments: 1905 and 1900.*

	1905	1900[1]
Number of establishments	2,330	3,149
Number of establishments reporting power	1,675	1,990
Total horsepower	344,671	203,774
Owned:		
Engines—		
Steam—		
Number	2,550	2,162
Horsepower	316,572	169,322
Gas and gasoline—		
Number	84	....
Horsepower	1,941	....
Water wheels—		
Number	309	524
Horsepower	17,093	30,495
Water motors—		
Number	5	(2)
Horsepower	39	(2)
Electric motors—		
Number	419	....
Horsepower	8,776	....
Other power, horsepower	250	3,957

[1] Exclusive of the hand trades and neighborhood industries, omitted from the census of 1905.
[2] Not reported separately.

Combining the power reported by idle establishments with that of active establishments shown in Table 1 gives an aggregate of 14,986,215 available horsepower for 1905, compared with 10,613,399 horsepower for 1900, or an increase of 41.2 per cent.

The totals given in Table 2 are not included in any tables of this report.

POWER IN SELECTED INDUSTRIES.

The power reported at the last four censuses for 11 selected industries and for all industries combined is shown in Table 3, which also gives the percentage that the different kinds of power form of the total employed in each of the several industries. These industries are not those reporting the largest amount of horsepower, but were selected as being typical of the factory method of manufacture.

It will be observed from Table 3 that the 11 selected industries absorbed slightly more than one-half of the total amount of horsepower reported for all industries at the census of 1905, namely, 7,795,780 horsepower, leaving 6,845,764 horsepower for the other industries of the country. In power consumption the manufacture of iron and steel is by far the most important of American industries, requiring not less than 2,722,508 horsepower, which, it may be incidentally noted, was very largely obtained from steam. All other sources of energy resorted to in this field are practically negligible, forming only 12.8 per cent of the total. These conditions are paralleled in the lumber and timber industry, which is next in importance as to power required, taking 1,504,693 horsepower, of which over 90 per cent is in steam.

The manufacture of paper and wood pulp is third in importance, requiring 1,122,564 horsepower, closely approached by cotton goods, employing 1,039,648 horsepower. The next largest branch of industry, when viewed with reference to power, is that which deals with flour and grist mill products, for which a total was returned of 780,042 horsepower.

No other of the industries shown in Table 3 reached anything like the same importance, although some of them have made remarkable strides in the last twenty-five years. Thus, for example, the total horsepower required for worsted goods in 1880 was only 16,437. At the census of 1905 it had become 130,620, an increase of almost sevenfold. In like manner the power required for hosiery and knit goods rose from 11,561 horsepower in 1880 to 83,814 horsepower at the census of 1905, this being an increase of over sixfold. These are industries in which the amount and value of products have increased greatly; and a further analysis establishing the relationship of the horsepower they consume to the kind and quantity of their products would be of interest as indicative of the greater refinement and increasing variety of American manufactures.

TABLE 3.—POWER, BY KIND, IN SELECTED INDUSTRIES, WITH PER CENT DISTRIBUTION OF TOTAL HORSEPOWER: 1880 TO 1905.[1]

[For 1900 the horsepower includes the hand trades and neighborhood industries, except custom gristmills, custom sawmills, and cotton ginning. Prior to 1900 the horsepower includes all hand trades and neighborhood industries.]

INDUSTRY.	1905							1900						
	Total horsepower.	Steam.		Water.		All other.		Total horsepower.	Steam.		Water.		All other.	
		Horsepower.	Per cent of total horsepower.	Horsepower.	Per cent of total horsepower.	Horsepower.	Per cent of total horsepower.		Horsepower.	Per cent of total horsepower.	Horsepower.	Per cent of total horsepower.	Horsepower.	Per cent of total horsepower.
All industries	14,641,544	10,828,111	73.9	1,647,969	11.3	2,165,464	14.8	10,409,625	8,140,533	78.2	1,454,229	14.0	814,863	7.8
Agricultural implements	106,623	75,018	70.4	6,300	5.9	25,205	23.7	77,189	61,147	79.2	6,758	8.8	9,284	12.0
Boots and shoes	62,587	40,228	64.3	1,612	2.6	20,747	33.1	50,623	34,666	68.5	2,240	4.4	13,717	27.1
Cotton goods[2]	1,039,648	707,607	68.1	252,923	24.3	79,118	7.6	811,347	531,611	65.5	255,875	31.5	23,861	3.0
Flour and grist mill products	780,042	473,689	60.7	258,352	33.1	48,001	6.2	672,084	407,475	60.6	242,821	36.1	21,788	3.3
Hosiery and knit goods	83,814	57,460	68.6	13,532	16.1	12,822	15.3	58,087	39,693	68.3	14,824	25.5	3,570	6.2
Iron and steel (blast furnaces, and steel works and rolling mills)	2,722,508	2,372,994	87.2	5,475	0.2	344,039	12.6	1,670,547	1,581,695	94.7	8,649	0.5	80,203	4.8
Lumber and timber products	1,504,693	1,377,722	91.6	103,677	6.9	23,294	1.5	1,383,002	1,226,091	88.7	146,500	10.6	10,411	0.7
Paper and wood pulp	1,122,564	370,852	33.0	717,989	64.0	33,723	3.0	764,847	255,854	33.4	504,762	66.0	4,231	0.6
Silk and silk goods	78,888	56,362	71.5	6,974	8.8	15,552	19.7	61,395	45,959	74.8	6,666	10.9	8,770	14.3
Woolen goods	163,793	96,940	59.2	55,931	34.1	10,922	6.7	139,645	82,933	59.4	52,358	37.5	4,354	3.1
Worsted goods	130,620	95,111	72.8	16,834	12.9	18,675	14.3	97,383	73,180	75.2	20,491	21.0	3,712	3.8
All other industries	6,845,764	5,104,128	74.6	208,370	3.0	1,533,266	22.4	4,623,476	3,800,229	82.2	192,285	4.2	630,962	13.6

INDUSTRY.	1890							1880				
	Total horsepower.	Steam.		Water.		All other.		Total horsepower.	Steam.		Water.	
		Horsepower.	Per cent of total horsepower.	Horsepower.	Per cent of total horsepower.	Horsepower.	Per cent of total horsepower.		Horsepower.	Per cent of total horsepower.	Horsepower.	Per cent of total horse power.
All industries	5,954,655	4,662,029	78.3	1,263,343	21.2	29,283	0.5	3,410,837	2,185,458	64.1	1,225,379	35.9
Agricultural implements	50,395	40,673	80.7	9,667	19.2	55	0.1	44,731	32,086	71.7	12,645	28.3
Boots and shoes	30,686	27,885	90.9	1,874	6.1	927	3.0	11,574	11,164	96.5	410	3.5
Cotton goods	464,881	265,509	57.1	198,982	42.8	390	0.1	275,504	126,750	46.0	148,754	54.0
Flour and grist mill products	752,365	366,587	48.7	383,872	51.0	1,906	0.3	771,201	301,214	39.1	469,987	60.9
Hosiery and knit goods	34,538	22,005	63.7	12,360	35.8	173	0.5	11,561	6,069	52.5	5,492	47.5
Iron and steel (blast furnaces, and steel works and rolling mills)	745,824	737,771	98.9	8,053	1.1	...	...	397,247	380,741	95.8	16,506	4.2
Lumber and timber products	961,316	759,078	78.9	201,651	21.0	587	0.1	821,928	543,242	66.1	278,686	33.9
Paper and wood pulp	297,724	93,659	31.4	203,896	68.5	169	0.1	123,912	36,301	29.3	87,611	70.7
Silk and silk goods	29,638	24,427	82.4	4,864	16.4	347	1.2	8,810	7,248	82.3	1,562	17.7
Woolen goods	122,501	67,195	54.9	55,030	44.9	276	0.2	106,507	52,897	49.7	53,610	50.3
Worsted goods	57,111	44,458	77.8	12,437	21.8	216	0.4	16,437	10,135	61.7	6,302	38.3
All other industries	2,407,676	2,212,782	91.9	170,657	7.1	24,237	1.0	821,425	677,611	82.5	143,814	17.5

[1] For 1890 steam and water power represent owned and rented power. At subsequent censuses rented power was not segregated as to steam and water; the totals therefore represent owned power only.
[2] Includes cotton small wares.

The relative increase in power employed in the selected industries just referred to is brought out more clearly and fully in Table 4, which shows the power used in them from 1870 to 1905, with the amount and per cent of increase. This table shows also the kind of power used in each industry and its per cent of increase at each period.

TABLE 4.—POWER, BY KIND, IN SELECTED INDUSTRIES, WITH AMOUNT AND PER CENT OF INCREASE: 1870 TO 1905.[1]

[For 1900 the horsepower includes the hand trades and neighborhood industries, except custom gristmills, custom sawmills, and cotton ginning. Prior to 1900 the horsepower includes all hand trades and neighborhood industries.]

INDUSTRY.	TOTAL HORSEPOWER.					INCREASE.							
	1905	1900	1890	1880	1870	1900 to 1905		1890 to 1900		1880 to 1890		1870 to 1880	
						Amount.	Per cent.	Amount.	Per cent.	Amount.	Per cent.	Amount.	Per cent.
All industries	14,641,544	10,409,625	5,954,655	3,410,837	2,346,142	4,231,919	40.7	4,454,970	74.8	2,543,818	74.6	1,064,695	45.4
Agricultural implements	106,623	77,189	50,395	44,731	26,082	29,434	38.1	26,794	53.2	5,664	12.7	18,649	71.5
Boots and shoes	62,587	50,623	30,686	11,574	3,055	11,964	23.6	19,937	65.0	19,112	165.1	8,519	278.9
Cotton goods[2]	1,039,648	811,347	464,881	275,504	146,040	228,301	28.1	346,466	74.5	189,377	68.7	129,464	88.6
Flour and grist mill products	780,042	672,084	752,365	771,201	576,686	107,958	16.1	[3]80,281	[3]10.7	[3]18,836	[3]2.4	194,515	33.7
Hosiery and knit goods	83,814	58,087	34,538	11,561	6,498	25,727	44.3	23,549	68.2	22,977	198.8	5,063	77.9
Iron and steel (blast furnaces, and steel works and rolling mills)	2,722,508	1,670,547	745,824	397,247	170,675	1,051,961	63.0	924,723	124.0	348,577	87.7	226,572	132.8
Lumber and timber products	1,504,693	1,383,002	961,316	821,928	641,665	121,691	8.8	421,686	43.9	139,388	17.0	180,263	28.1
Paper and wood pulp	1,122,564	764,847	297,724	123,912	54,287	357,717	46.8	467,123	156.9	173,812	140.3	69,625	128.3
Silk and silk goods	78,888	61,395	29,638	8,810	1,911	17,493	28.5	31,757	107.1	20,828	236.4	6,899	361.0
Woolen goods	163,793	139,645	122,501	106,507	85,101	24,148	17.3	17,144	14.0	15,994	15.0	21,406	25.2
Worsted goods	130,620	97,383	57,111	16,437	8,016	33,237	34.1	40,272	70.5	40,674	247.5	8,421	105.1
All other industries	6,845,764	4,623,476	2,407,676	821,425	626,126	2,222,288	48.1	2,215,800	92.0	1,586,251	193.1	195,299	31.2

INDUSTRY.	STEAM.					INCREASE.							
	1905	1900	1890	1880	1870	1900 to 1905		1890 to 1900		1880 to 1890		1870 to 1880	
						Amount.	Per cent.	Amount.	Per cent.	Amount.	Per cent.	Amount.	Per cent.
All industries	10,828,111	8,140,533	4,662,029	2,185,458	1,215,711	2,687,578	33.0	3,478,504	74.6	2,476,571	113.3	969,747	79.8
Agricultural implements	75,018	61,147	40,673	32,086	15,873	13,871	22.7	20,474	50.3	8,587	26.8	16,213	102.1
Boots and shoes	40,228	34,666	27,885	11,164	2,892	5,562	16.0	6,781	24.3	16,721	149.8	8,272	286.0
Cotton goods	707,607	531,611	265,509	126,750	46,967	175,996	33.1	266,102	100.2	138,759	109.5	79,783	169.9
Flour and grist mill products	473,689	407,475	366,587	301,214	168,736	66,214	16.2	40,888	11.2	65,373	21.7	132,478	78.5
Hosiery and knit goods	57,460	39,693	22,005	6,069	2,223	17,767	44.8	17,688	80.4	15,936	262.6	3,846	173.0
Iron and steel (blast furnaces, and steel works and rolling mills)	2,372,994	1,581,695	737,771	380,741	154,091	791,299	50.0	843,924	114.4	357,030	93.8	226,650	147.1
Lumber and timber products	1,377,722	1,226,091	759,078	543,242	314,884	151,631	12.4	467,013	61.5	215,836	39.7	228,358	72.5
Paper and wood pulp	370,852	255,854	93,659	36,301	11,574	114,998	44.9	162,195	173.2	57,358	158.0	24,727	213.6
Silk and silk goods	56,362	45,959	24,427	7,248	1,122	10,403	22.6	21,532	88.1	17,179	237.0	6,126	546.0
Woolen goods	96,940	82,933	67,195	52,897	32,195	14,007	16.9	15,738	23.4	14,298	27.0	20,702	64.3
Worsted goods	95,111	73,180	44,458	10,135	3,382	21,931	30.0	28,722	64.6	34,323	338.7	6,753	199.7
All other industries	5,104,128	3,800,229	2,212,782	677,611	461,772	1,303,899	34.3	1,587,447	71.7	1,535,171	226.6	215,839	46.7

INDUSTRY.	WATER.					INCREASE.							
	1905	1900	1890	1880	1870	1900 to 1905		1890 to 1900		1880 to 1890		1870 to 1880	
						Amount.	Per cent.	Amount.	Per cent.	Amount.	Per cent.	Amount.	Per cent.
All industries	1,647,969	1,454,229	1,263,343	1,225,379	1,130,431	193,740	13.3	190,886	15.1	37,964	3.1	94,948	8.4
Agricultural implements	6,300	6,758	9,667	12,645	10,209	[3]458	[3]6.8	[3]2,909	[3]30.1	[3]2,978	[3]23.6	2,436	23.9
Boots and shoes	1,612	2,240	1,874	410	163	[3]628	[3]28.0	[illegible]	19.5	1,464	357.1	247	151.5
Cotton goods	252,923	255,875	198,982	148,754	9[illegible],073	[3]2,952	[3]1.2	56,893	28.6	50,228	33.8	49,681	50.1
Flour and grist mill products	258,352	242,821	383,872	469,987	407,950	15,531	6.4	[3]141,051	[3]36.7	[3]86,115	[3]18.3	62,037	15.2
Hosiery and knit goods	13,532	14,824	12,360	5,492	4,275	[3]1,292	[3]8.7	2,464	19.9	6,868	125.1	1,217	28.5
Iron and steel (blast furnaces, and steel works and rolling mills)	5,475	8,649	8,053	16,506	16,584	[3]3,174	[3]36.7	596	7.4	[3]8,453	[3]51.2	[3]78	[3]0.5
Lumber and timber products	103,677	146,500	201,651	278,686	326,781	[3]42,823	[3]29.2	[3]55,151	[3]27.3	[3]77,035	[3]27.6	[3]48,095	[3]14.7
Paper and wood pulp	717,989	504,762	203,896	87,611	42,713	213,227	42.2	300,866	147.6	116,285	132.7	44,898	105.1
Silk and silk goods	6,974	6,666	4,864	1,562	789	308	4.6	1,802	37.0	3,302	211.4	773	98.0
Woolen goods	55,961	52,388	55,030	53,610	52,906	3,573	6.8	[3]2,672	[3]4.9	1,420	2.6	704	1.3
Worsted goods	16,834	20,491	12,437	6,302	4,634	[3]3,657	[3]17.8	8,054	64.8	6,135	97.4	1,668	36.0
All other industries	208,370	192,285	170,657	143,814	164,354	16,085	8.4	21,628	12.7	26,843	18.7	[3]20,540	[3]12.5

[1] For 1890 steam and water power represent owned and rented power. At subsequent censuses rented power was not segregated as to steam and water; the totals therefore represent owned power only.
[2] Includes cotton small wares.
[3] Decrease.

TABLE 4.—POWER, BY KIND, IN SELECTED INDUSTRIES, WITH AMOUNT AND PER CENT OF INCREASE: 1870 TO 1905—Continued.

[For 1900 the horsepower includes the hand trades and neighborhood industries, except custom gristmills, custom sawmills, and cotton ginning. Prior to 1900 the horsepower includes all hand trades and neighborhood industries.]

INDUSTRY.	ALL OTHER.			INCREASE.			
				1900 to 1905		1890 to 1900	
	1905	1900	1890	Amount.	Per cent.	Amount.	Per cent.
All industries	2,165,464	814,863	29,283	1,350,601	165.7	785,580	2,682.7
Agricultural implements	25,305	9,284	55	16,021	172.6	9,229	16,780.0
Boots and shoes	20,747	13,717	927	7,030	51.3	12,790	1,379.7
Cotton goods	79,118	23,861	390	55,257	231.6	23,471	6,018.2
Flour and grist mill products	48,001	21,788	1,906	26,213	120.3	19,882	1,043.1
Hosiery and knit goods	12,822	3,570	173	9,252	259.2	3,397	1,963.6
Iron and steel (blast furnaces, and steel works and rolling mills)	344,039	80,203		263,836	329.0	80,203	
Lumber and timber products	23,294	10,411	587	12,883	123.7	9,824	1,673.6
Paper and wood pulp	33,723	4,231	169	29,492	697.0	4,062	2,403.6
Silk and silk goods	15,552	8,770	347	6,782	77.3	8,423	2,427.4
Woolen goods	10,922	4,354	276	6,568	150.8	4,078	1,477.5
Worsted goods	18,675	3,712	216	14,963	403.1	3,496	1,618.5
All other industries	1,533,266	630,962	24,237	902,304	143.0	606,725	2,503.3

It will be observed that since 1870 the relative position of the selected industries has varied in rather a remarkable manner. For example, in 1870 the iron and steel industry was third on the list, with only 170,675 horsepower, being exceeded by the lumber and the flour and grist mill industries, each of which employed considerably over half a million horsepower. It held the same rank in 1880 and in 1890, although by that time it had risen almost to an equality with flour and grist mills. The next decade, however, witnessed enormous strides, and saw it rise to the first rank. At the census of 1905 its preeminence was so marked that its horsepower was actually larger than that of the flour and grist and lumber and timber industries combined, being 2,722,508 horsepower, as compared with 2,284,735 of the two industries. This is perhaps the most striking change observable in the whole group of selected industries.

A further instance of remarkable growth, but of a more steady character, is seen in the cotton industry, in which in 1870 only 146,040 horsepower was employed. This increased in the decade 1870 to 1880 by 129,464, or 88.6 per cent, and in the next ten years 68.7 per cent. In 1900 the per cent of increase was 74.5 and the total horsepower reported was 811,347. While this rate has not been maintained, which could hardly have been expected, the amount reported for the census period ending with 1905 was not less than 1,039,648 horsepower, placing the production of cotton goods in the fourth rank as to power plant.

The greatest decline in percentages of increase, although the amount of power consumed is not large, are those exhibited by silk and silk goods, in which industry the amount of power required rose from 1,911 horsepower in 1870 to 78,888 horsepower at the census of 1905. While the absolute increase in power required in the industry is notable, the per cent of increase has naturally fallen off.

Some very singular changes are brought to notice by the figures relating to the increase in the kind of power, but statements and inferences with regard to them must be presented with caution, chiefly because of the introduction of electric power into every branch of manufacture. This form of energy is not in itself a prime mover, but is a means of transmission and distribution, standing between the original steam, water, or even gas power, and the consumption apparatus to which the transformed and transmitted energy is delivered. Hence, as will be seen, the percentages of increase for "all other power," in which electric power is included, are far in excess of those reported for steam and water. The increase for "all other power" in the period 1900 to 1905 was 165.7 per cent, although this is small compared with the extraordinary increase of nearly twenty-seven fold in the census period 1890 to 1900. In some of the selected industries, also, the increased use of "all other power" between 1900 and 1905 was striking, being 697 per cent in the paper and wood pulp industry. This is wholly attributable to the increased use of electric power.

Table 5 shows the total horsepower employed in the 11 selected industries, with the percentage of increase, the power installed per wage-earner, and the power per $1,000 of products, from 1870 to 1905.

TABLE 5.—POWER IN SELECTED INDUSTRIES, WITH PER CENT OF INCREASE; HORSEPOWER PER WAGE-EARNER; AND HORSEPOWER PER $1,000 OF PRODUCTS: 1870 TO 1905.

INDUSTRY.	Census.	Horsepower.	Per cent of increase in horsepower.	Average number of wage-earners.	Horsepower per wage-earner.	Value of products.	Horsepower per $1,000 of products.
Agricultural implements	1905	106,623	38.1	47,394	2.2	$112,007,344	1.0
	1900	77,189	53.2	46,582	1.7	101,207,428	0.8
	1890	50,395	12.7	38,827	1.3	81,271,651	0.6
	1880	44,731	71.5	39,580	1.1	68,640,486	0.7
	1870	26,082	....	25,249	1.0	52,066,875	0.5
Boots and shoes	1905	62,587	23.6	149,924	0.4	320,107,458	2.0
	1900	50,623	65.0	141,830	0.4	258,969,580	0.2
	1890	30,686	165.1	133,690	0.2	220,649,358	0.1
	1880	11,574	278.9	111,152	0.1	166,050,354	0.1
	1870	3,055	....	91,702	(1)	146,704,055	(1)
Cotton goods [2]	1905	1,039,648	28.1	315,874	3.3	450,467,704	2.3
	1900	811,347	74.5	302,861	2.7	339,200,320	2.4
	1890	464,881	68.7	218,876	2.1	267,981,724	1.7
	1880	275,504	88.6	185,472	1.5	210,950,383	1.3
	1870	146,040	....	135,519	1.1	177,489,739	0.8
Flour and grist mill products	1905	[3] 780,042	16.1	39,110	19.9	713,033,395	1.1
	1900	672,084	[4] 10.7	32,226	20.9	501,396,304	1.3
	1890	752,365	[4] 2.4	47,403	15.9	513,971,474	1.5
	1880	771,201	33.7	58,407	13.2	505,185,712	1.5
	1870	576,686	....	58,448	9.9	444,985,143	1.3
Hosiery and knit goods	1905	83,814	44.3	103,715	0.8	136,558,139	0.6
	1900	58,087	68.2	83,387	0.7	95,482,566	0.6
	1890	34,538	198.8	59,588	0.6	67,241,013	0.5
	1880	11,561	77.9	28,885	0.4	29,167,227	0.4
	1870	6,498	....	14,788	0.4	18,411,564	0.4
Iron and steel (blast furnaces, and steel works and rolling mills)	1905	2,722,508	63.0	242,640	11.2	905,787,733	3.0
	1900	1,670,547	124.0	222,490	7.5	803,968,273	2.1
	1890	745,824	87.7	148,715	5.0	478,687,519	1.6
	1880	397,247	132.8	140,978	2.8	296,557,685	1.3
	1870	170,675	....	77,555	2.2	307,208,696	0.6
Lumber and timber products	1905	[3] 1,504,693	8.8	404,626	3.7	580,022,690	2.6
	1900	1,383,002	43.9	413,335	3.3	555,197,271	2.5
	1890	961,316	17.0	311,964	3.1	437,957,382	2.2
	1880	821,928	28.1	147,956	5.6	233,268,729	3.5
	1870	641,665	....	149,[illegible]97	4.3	210,159,327	3.1
Paper and wood pulp	1905	1,122,564	46.8	65,964	17.0	188,715,189	5.9
	1900	764,847	156.9	49,646	15.4	127,326,162	6.0
	1890	297,724	140.3	31,050	9.6	78,937,184	3.8
	1880	[5] 123,912	128.3	25,631	4.8	55,109,914	2.2
	1870	54,287	....	18,021	3.0	50,842,445	1.1
Silk and silk goods	1905	78,888	28.5	79,601	1.0	133,288,072	0.6
	1900	61,395	107.1	65,416	0.9	107,256,258	0.6
	1890	29,638	236.4	49,382	0.6	87,298,454	0.3
	1880	8,810	361.0	31,337	0.3	41,033,045	0.2
	1870	1,911	....	6,699	0.3	12,210,662	0.2
Woolen goods	1905	163,793	17.3	72,747	2.3	142,196,658	1.2
	1900	139,645	14.0	68,893	2.0	118,430,158	1.2
	1890	122,501	15.0	76,915	1.6	133,577,977	0.9
	1880	106,507	25.2	86,504	1.2	160,606,721	0.7
	1870	85,101	....	77,870	1.1	155,405,358	0.5
Worsted goods	1905	130,620	34.1	69,251	1.9	165,745,052	0.8
	1900	97,383	70.5	57,008	1.7	120,314,344	0.8
	1890	57,111	247.5	42,978	1.3	79,194,652	0.7
	1880	16,437	105.1	18,803	0.9	33,549,942	0.5
	1870	8,016	....	12,920	0.6	22,090,331	0.4

[1] Less than one-tenth of 1 horsepower.
[2] Includes cotton small wares.
[3] Exclusive of custom mills.
[4] Decrease.
[5] Horsepower exclusive of "wood pulp," for which figures were not accessible.

These figures as a whole may be taken to represent the further transition from hand labor to power driven machinery, as there has been a steady rise in all but 2 of the 11 industries in the average amount of power utilized per wage-earner. It will be seen from this table that the amount of horsepower per wage-earner in the production of agricultural implements has risen in the thirty-five years from 1 horsepower to 2.2. In like manner the value of products and the horsepower per $1,000 of products have doubled. But the power per wage-earner in the lumber and timber industry has fallen off. In 1870 the average power per wage-earner was 4.3, but at the census of 1905 it was only 3.7, and the horsepower per $1,000 of products, which in 1870 was 3.1, had declined to 2.6. In the paper and wood pulp industry, to some extent allied to that of lumber and timber, the power per wage-earner in 1870 was 3, but it was 17 at the census of 1905, almost a fivefold increase. The horsepower per $1,000 of products had risen from 1.1 to 5.9. The iron and steel industry since 1870 shows an increase in horsepower per wage-earner from 2.2 to 11.2, while the horsepower per $1,000 of products had risen from six-tenths of 1 to 3. During this period the boot and shoe industry underwent a remarkable process of development and transition from handicraft to machine production. In 1880 the

average horsepower per wage-earner was one-tenth of 1, but it had risen by 1905 to four-tenths of 1. During the same period the horsepower per $1,000 of products had increased from one-tenth of 1 to 2. No statistics are available to show the actual production of shoes in the country by handpower, but these figures contain an indication of the extent to which the power-made shoe has supplanted that which was made in the old hand shop where every customer had an individual last.

A very remarkable increase is exhibited in the industry of silk and silk goods. The power per wage-earner increased from three-tenths of 1 in 1870 to 1 at the census of 1905, and the horsepower per $1,000 of products from two-tenths of 1 to six-tenths of 1, a twofold increase. During the same period the products increased approximately from $12,000,000 to over $133,000,000, or about tenfold.

Between the industries of silk and silk goods and paper and wood pulp there is an extraordinary contrast at the census of 1905. The average per wage-earner in the paper and wood pulp industry, 17 horsepower, compares with 1 horsepower in the silk industry and 5.9 horsepower per $1,000 of products compares with six-tenths of 1. The total value of the paper and wood pulp products is $188,715,189, as compared with $133,288,072 of silk and silk goods. Such a result naturally arises from the great difference in the character of the materials, and is also due to the fact that labor has been supplanted largely by machinery in the production of widely different products.

This condition is signally exemplified also by the products of worsted goods. It is somewhat surprising to find that for 1905 these fall only $20,000,000 short in value of the paper and wood pulp industry. The power capacity per wage-earner in the worsted industry is only 1.9, and the horsepower per $1,000 of products is only eight-tenths of 1.

GEOGRAPHIC DISTRIBUTION OF POWER.

In Table 6 is given the total horsepower and percentage of steam, water, and other power, distributed by geographic divisions, from 1870 to 1905.

TABLE 6.—POWER, BY KIND, WITH PER CENT DISTRIBUTION OF TOTAL HORSEPOWER, BY GEOGRAPHIC DIVISIONS: 1870 TO 1905.[1]

[For 1900 the horsepower includes the hand trades and neighborhood industries, except custom gristmills, custom sawmills, and cotton ginning. Prior to 1900 the horsepower includes all hand trades and neighborhood industries.]

DIVISION.	1905							1900						
	Total horsepower.	Steam.		Water.		All other.		Total. horsepower.	Steam.		Water.		All other.	
		Horsepower.	Per cent of total horsepower.	Horsepower.	Per cent of total horsepower.	Horsepower.	Per cent of total horsepower.		Horsepower.	Per cent of total horsepower.	Horsepower.	Per cent of total horsepower.	Horsepower.	Per cent of total horsepower.
United States	14,641,544	10,828,111	73.9	1,647,969	11.3	2,165,464	14.8	10,409,625	8,140,533	78.2	1,454,229	14.0	814,863	7.8
New England states	2,254,264	1,335,547	59.3	659,071	29.2	259,646	11.5	1,826,680	1,093,431	59.9	619,209	33.9	114,040	6.2
Middle states	5,000,367	3,520,680	70.4	531,718	10.6	947,969	19.0	3,453,468	2,685,832	77.8	426,356	12.3	341,280	9.9
Southern states	2,386,330	2,085,160	87.4	147,680	6.2	153,490	6.4	1,601,184	1,410,956	88.1	136,514	8.5	53,714	3.4
Central states	4,077,298	3,185,875	78.1	243,374	6.0	648,049	15.9	2,984,781	2,528,911	84.7	206,437	6.9	249,433	8.4
Western states	445,937	339,084	76.0	33,475	7.5	73,378	16.5	260,435	199,524	76.6	34,800	13.4	26,111	10.0
Pacific states	474,397	359,002	75.7	32,562	6.9	82,833	17.4	281,719	220,925	78.4	30,796	10.9	29,998	10.7
Outlying districts	2,951	2,763	93.6	89	3.0	99	3.4	1,358	954	70.3	117	8.6	287	21.1

DIVISION.	1890							1880					1870				
	Total horsepower.	Steam.		Water.		All other.		Total. horsepower.	Steam.		Water.		Total horsepower.	Steam.		Water.	
		Horsepower.	Per cent of total horsepower.	Horsepower.	Per cent of total horsepower.	Horsepower.	Per cent of total horsepower.		Horsepower.	Per cent of total horsepower.	Horsepower.	Per cent of total horsepower.		Horsepower.	Per cent of total horsepower.	Horsepower.	Per cent of total horsepower.
United States	5,954,655	4,662,029	78.3	1,263,343	21.2	29,283	0.5	3,410,837	2,185,458	64.1	1,225,379	35.9	2,346,142	1,215,711	51.8	1,130,431	48.2
New England states	1,159,971	654,039	56.4	501,629	43.2	4,303	0.4	743,106	320,201	43.1	422,905	56.9	514,730	152,704	29.7	362,026	70.3
Middle states	2,055,645	1,690,144	82.2	355,088	17.3	10,413	0.5	1,136,239	755,841	66.5	380,398	33.5	799,264	399,413	50.0	399,851	50.0
Southern states	799,404	632,652	79.1	163,803	20.5	2,949	0.4	434,876	265,572	61.1	169,304	38.9	321,498	161,415	50.2	160,083	49.8
Central states	1,667,434	1,457,045	87.4	200,941	12.0	9,448	0.6	996,883	782,022	78.4	214,861	21.6	645,558	461,785	71.5	183,773	28.5
Western states	123,239	100,027	81.2	22,279	18.1	933	0.7	48,828	26,207	53.7	22,621	46.3	28,622	18,019	63.0	10,603	37.0
Pacific states	148,511	127,832	86.1	19,442	13.1	1,237	0.8	50,905	35,615	70.0	15,290	30.0	36,470	22,375	61.3	14,095	38.7
Outlying districts	451	290	64.3	161	35.7	......	......	......	......	......	......	......	......	......	......	......	......

[1] For 1890 steam and water power represent owned and rented power. At subsequent censuses rented power was not segregated as to steam and water; the totals therefore represent owned power only.

Table 6 is one of the most interesting in this report, exhibiting, as it does, the development of manufactures in sections of the country which had previously played a minor part in strictly industrial development. Of the total (14,641,544) horsepower, by far the larger part, no less than 9,077,665 horsepower, is shown to be in use in the Middle and Central states. Another significant fact is that for the first time in the history

of the country the horsepower employed in manufactures in the Southern states exceeds that reported for the New England states. At the census of 1870 the Southern states reported 321,498 horsepower, and the New England states, 514,730 horsepower. At the census of 1905 the Southern states reported 2,386,330 horsepower, exceeding that reported for New England by 132,066 horsepower. In this connection it is also interesting to note that the development in the Southern states has been largely due to the utilization of steampower, this being 87.4 per cent of the total at the census of 1905, and the waterpower being only 6.2 per cent, whereas in New England the percentage of waterpower was 29.2 and of steampower 59.3.

As far back as 1870 both the Middle and Central state groups had horsepower in manufactures in excess of New England. At the census of 1905 the Southern states reported 40,188 horsepower in excess of the total horsepower employed in manufactures in the whole country thirty-five years earlier. Curiously enough, however, the proportion of power developed in the Southern states has remained roughly about one-seventh of the whole throughout the entire period.

In 1870 there was very little manufacturing development in any of the Pacific or far Western states, so that in that year the total for these two geographic divisions was only 65,092 horsepower. It will be understood, however, that these figures do not include mining operations, in which even at that period the development west of the Missouri was very large. The actual increase in the next decade was comparatively small, but since 1890 the growth has been rapid, so that, as will be seen, at the census of 1905 the Pacific states reported 474,397 horsepower and the Western states 445,937 horsepower. To a striking extent also, as will be noted, steampower has preponderated throughout the entire period. At the last census period the percentage of steampower in these sections was, for the Pacific states, 75.7, and for the Western, 76; while waterpower had fallen from 38.7 and 37 per cent, respectively, in 1870 to as low as 6.9 and 7.5 per cent at the census of 1905, subject to the corrections for "all other power" due to the influence of electrical transmission.

STEAMPOWER.

Table 7 presents the statistics as to the amount of steampower used in the states and territories at the censuses of 1870 to 1905, inclusive, with the amount and per cent of increase.

The fact has already been brought out that throughout the entire period steam has been the dominant primary power, and the census returns show that it has rapidly risen in relative importance—from 51.8 per cent of the whole in 1870 to 73.9 per cent for 1905. In other words, out of a total of 14,641,544 horsepower reported for 1905, steam contributed 10,828,111 horsepower. American industry as it develops tends more and more to the application of power to products of smaller bulk and a higher value of finished article. At the same time, with the increasing amount of steam used, the cost of steampower becomes less, owing to the great increase in the size of the units employed. In this connection it is noticeable that there were actually fewer steam engines in use as reported at the census of 1905 than in 1900, but, on the other hand, the average size of the units had risen from 39 horsepower in 1880 to 50 horsepower in 1890, 62 in 1900, and 85 at the census of 1905. As a matter of fact, however, these statistics are confused or vitiated by the fact that while the average steam engine to-day in a new mill or factory is of several hundred horsepower, steam has been increasingly used as a means of operating the auxiliary apparatus, such as pumps, stokers, blowers, conveyers, etc., although here also the electric motor has found increasing use.

The effect of a "heavy" industry on the utilization of steampower is strikingly illustrated in Table 7, from which it will be seen that Pennsylvania, the principal center of the iron and steel industry, is credited with 2,088,773 steam horsepower, or almost 20 per cent of the total for the whole country. In like manner, the large amount of 1,028,665 horsepower is reported for Ohio, so that these two states have nearly 30 per cent of the entire steampower employed in all manufactures, as the result largely of the use of motive power in the metal industries. In point of importance New York comes third with 850,497 horsepower, followed by Massachusetts, with 690,467 horsepower, and Illinois, with 651,578.

The percentage of increase in these states from 1900 to 1905 was 31.6 for Pennsylvania, 40.5 for Ohio, 28.9 for New York, 19.8 for Massachusetts, and 28.4 for Illinois. As might be expected, the largest percentage of increase was shown in some of the Western states and territories, such as Alaska, with 189.6 per cent; Arizona, 146 per cent; Colorado, 198.3 per cent; Idaho, 277.7 per cent; Indian Territory, 139.5 per cent; Oklahoma, 155.7 per cent; and Washington, 93.3 per cent.

The Southern states, however, were conspicuous for large increases. In Alabama the increase was from 162,453 horsepower to 280,470, a percentage of increase in the five years of 72.6. In Georgia the horsepower rose from 110,972 to 183,369, an increase of 65.2 per cent. In Mississippi the gain was from 64,731 horsepower to 109,418, an increase in the census period of 69 per cent. In North Carolina the percentage of increase was 49.2, namely, from 122,778 horsepower to 183,166. South Carolina, however, exceeded in gains all other Southern states, nearly doubling its horsepower, namely, from 80,913 to 157,432 horsepower, an increase of not less than 94.6 per cent. As will be observed from the table, these increases in the South are in line with those which were shown during the period from 1890 to 1900, although these states do not maintain the very large propor-

tionate gains which were shown prior to 1890, when the amounts dealt with were so small that an insignificant gain involved a relatively large percentage of increase. It is to be observed with regard to the Southern states that the gains were well distributed, although occurring chiefly in the regions enjoying the most rapid development of textile industries, mineral, and timber resources for manufacturing purposes.

In a preceding paragraph reference has been made to the average size of all engines employed, as well as the general effect of a "heavy" industry on the utilization of steampower. Data as to both conditions and their relationship, which are interesting in this connection, are to be found in Table 14 of the Report on Manufactures, Part I, showing the motive power for industries employing 50,000 horsepower and over at the census of 1905. Thus in the iron and steel blast furnaces the total for the United States was 1,555 engines of 762,382 horsepower, giving an average of 490 horsepower per engine. In Pennsylvania, with 582 engines and 298,567 horsepower, the average per engine was 513 horsepower. Both Ohio and Alabama showed a higher average than Pennsylvania, the 280 blast furnace engines in Ohio having an average of 599 horsepower, while the 163 engines employed in Alabama had an average of 615 horsepower per engine.

TABLE 7.—STEAMPOWER, WITH AMOUNT AND PER CENT OF INCREASE, BY STATES AND TERRITORIES: 1870 TO 1905.

[For 1900 the horsepower includes the hand trades and neighborhood industries, except custom gristmills, custom sawmills, and cotton ginning. Prior to 1900 the horsepower includes all hand trades and neighborhood industries.]

STATE OR TERRITORY.	HORSEPOWER.[1]					INCREASE.							
						1900 to 1905		1890 to 1900		1880 to 1890		1870 to 1880	
	1905	1900	1890	1880	1870	Amount.	Per cent.	Amount.	Per cent.	Amount.	Per cent.	Amount.	Per cent.
United States	10,828,111	8,140,533	4,662,029	2,185,458	1,215,711	2,687,578	33.0	3,478,504	74.6	2,476,571	113.3	969,747	79.8
Alabama	280,470	162,453	91,805	15,779	7,740	118,017	72.6	70,648	77.0	76,026	481.8	8,039	103.9
Alaska	2,763	954	290			1,809	189.6	664	229.0	290			
Arizona	18,828	7,653	497	370	80	11,175	146.0	7,156	1,439.8	127	34.3	290	362.5
Arkansas	107,699	78,016	36,525	13,709	6,101	29,683	38.0	41,491	113.6	22,816	166.4	7,608	124.7
California	153,178	105,190	67,426	28,071	18,493	47,988	45.6	37,764	56.0	39,355	140.2	9,578	51.8
Colorado	117,539	39,400	30,900	3,953	1,433	78,139	198.3	8,500	27.5	26,947	681.7	2,520	175.9
Connecticut	218,668	177,819	98,038	57,027	25,979	40,849	23.0	79,781	81.4	41,011	71.9	31,048	119.5
Dakota	(2)	(2)	(2)	1,421	248					6,047	425.5	1,173	473.0
Delaware	42,031	32,898	21,660	10,643	4,313	9,133	27.8	11,238	51.9	11,017	103.5	6,330	146.8
District of Columbia	10,513	8,630	10,473	2,263	789	1,883	21.8	[3] 1,843	[3] 17.6	8,210	362.8	1,474	186.8
Florida	41,975	35,044	15,492	6,208	3,172	6,931	19.8	19,552	126.2	9,284	149.5	3,036	95.7
Georgia	183,369	110,972	55,529	21,102	10,826	72,397	65.2	55,443	99.8	34,427	163.1	10,276	94.9
Idaho	15,145	4,010	972	546	311	11,135	277.7	3,038	312.6	426	78.0	235	75.6
Illinois	651,578	507,471	268,486	126,843	73,091	144,107	28.4	238,985	89.0	141,643	111.7	53,752	73.5
Indian Territory	12,104	5,053	349			7,051	139.5	4,704	1,347.9	349			
Indiana	336,932	296,926	174,060	109,960	76,851	40,006	13.5	122,866	70.6	64,100	58.3	33,109	43.1
Iowa	100,418	91,182	64,860	33,858	25,298	9,236	10.1	26,322	40.6	31,002	91.6	8,560	33.8
Kansas	83,039	55,518	34,882	13,468	6,360	27,521	49.6	20,636	59.2	21,414	159.0	7,108	111.8
Kentucky	162,829	136,122	75,836	45,917	31,928	26,707	19.6	60,286	79.5	29,919	65.2	13,989	43.8
Louisiana	245,745	187,492	29,446	11,256	24,924	58,253	31.1	158,046	536.7	18,190	161.6	[3] 13,668	[3] 54.8
Maine	126,818	89,257	43,748	20,759	9,465	37,561	42.1	45,509	104.0	22,989	110.7	11,294	119.3
Maryland	142,096	115,590	57,524	33,216	13,961	26,506	22.9	58,066	100.9	24,308	73.2	19,255	137.9
Massachusetts	690,467	576,525	355,226	171,397	78,502	113,942	19.8	221,299	62.3	183,829	107.3	92,895	118.3
Michigan	376,090	318,835	216,536	130,352	70,956	57,255	18.0	102,299	47.2	86,184	66.1	59,396	83.7
Minnesota	167,103	146,578	84,925	25,191	7,085	20,525	14.0	61,653	72.6	59,734	237.1	18,106	255.6
Mississippi	109,418	64,731	32,551	15,001	10,019	44,687	69.0	32,180	98.9	17,550	117.0	4,982	49.7
Missouri	221,215	173,271	139,189	72,587	48,418	47,944	27.7	34,082	24.5	66,602	91.8	24,169	49.9
Montana	32,356	32,008	2,122	544	822	348	1.1	29,886	1,408.4	1,578	290.1	[3] 278	[3] 33.8
Nebraska	34,012	31,048	17,196	2,999	1,865	2,964	9.5	13,852	80.6	14,197	473.4	1,134	60.8
Nevada	1,092	628	318	608	6,007	464	73.9	310	97.5	[3] 290	[3] 47.7	[3] 5,399	[3] 89.9
New Hampshire	102,439	89,905	47,652	18,595	8,787	12,534	13.9	42,253	88.7	29,057	156.3	9,808	111.6
New Jersey	386,770	281,306	162,178	72,792	32,307	105,464	37.5	119,128	73.5	89,386	122.8	40,485	125.3
New Mexico	5,097	3,283	1,502	427	252	1,814	55.3	1,781	118.6	1,075	251.8	175	69.4
New York	850,497	659,702	537,447	234,795	126,107	190,795	28.9	122,255	22.7	302,652	128.9	108,688	86.2
North Carolina	183,166	122,778	41,253	15,025	6,941	60,388	49.2	81,525	197.6	26,228	174.6	8,084	116.5
North Dakota	8,619	5,930	3,012	(4)	(4)	2,689	45.3	2,918	96.9				
Ohio	1,028,665	732,006	387,840	222,502	129,577	296,659	40.5	344,166	88.7	165,338	74.3	92,925	71.7
Oklahoma	15,593	6,098	161			9,495	155.7	5,937	3,687.6	161			
Oregon	55,512	37,986	22,731	4,334	2,471	17,526	46.1	15,255	67.1	18,397	424.5	1,863	75.4
Pennsylvania	2,088,773	1,587,706	900,862	402,132	221,936	501,067	31.6	686,844	76.2	498,730	124.0	180,196	81.2
Rhode Island	140,322	115,735	85,327	41,335	23,546	24,587	21.2	30,408	35.6	43,992	106.4	17,789	75.5
South Carolina	157,432	80,913	29,117	11,995	4,537	76,519	94.6	51,796	177.9	17,122	142.7	7,458	164.4
South Dakota	8,483	9,256	4,456	(4)	(4)	[3] 773	[3] 8.4	4,800	107.7				
Tennessee	161,919	116,715	68,728	33,388	18,467	45,204	38.7	47,987	69.8	35,340	105.8	14,921	80.8
Texas	155,312	110,943	65,515	28,026	11,214	44,369	40.0	45,428	69.3	37,489	133.8	16,812	149.9
Utah	12,162	7,606	2,562	1,154	331	4,556	59.9	5,044	196.9	1,408	122.0	823	248.6
Vermont	56,833	44,190	24,048	11,088	6,425	12,643	28.6	20,142	83.8	12,960	116.9	4,663	72.6
Virginia	143,917	109,392	45,590	19,710	8,410	34,525	31.6	63,802	139.9	25,880	131.3	11,300	134.4
Washington	150,312	77,749	37,675	3,210	1,411	72,563	93.3	40,074	106.4	34,465	1,073.7	1,799	127.5
West Virginia	124,212	84,234	44,755	28,456	17,136	39,978	47.5	39,479	88.2	16,299	57.3	11,320	66.1
Wisconsin	303,874	262,642	121,149	60,729	30,509	41,232	15.7	141,493	116.8	60,420	99.5	30,220	99.1
Wyoming	2,712	3,184	1,608	717	310	[3] 472	[3] 14.8	1,576	98.0	891	124.3	407	131.3

[1] For 1890 the horsepower represents owned and rented power. At subsequent censuses rented power was not segregated as to steam; the totals therefore represent owned power only.
[2] See North Dakota and South Dakota.
[3] Decrease.
[4] See Dakota.

The steel works and rolling mills of the country, as compared with the blast furnaces, employed steam units of a lower capacity, but such engines were far beyond the average size of units employed in all manufactures. There were 5,746 engines in steel works and rolling mills, with a total of 1,610,612 horsepower, or an average of 280 horsepower per unit. This is slightly above the average size in Pennsylvania, where 3,323 engines had a capacity of 799,323 horsepower, or 241 horsepower per unit, but in Illinois and Ohio the size was 405 horsepower, while in Alabama the average for 129 engines was not less than 440 horsepower. It is to be observed, moreover, that the size of the average steam unit for all blast furnaces and steel works and rolling mills has increased rapidly, having been 171 horsepower for 1890, 235 horsepower for 1900, and 325 horsepower for 1905.

The nature of an industry is fairly well indicated by the size of the steam units applied to it, although there are incidental factors to be taken into consideration that dictate in some industries the division of motive power into a number of units rather than its concentration into one or two generators of given capacity. At the census of 1905 the average size of steam engines in the cotton goods industry was 351 horsepower, while the average for blast furnaces was 490 horsepower. The average steam unit in steel works and rolling mills was 280 horsepower. The average in the worsted industry was 195 horsepower, but in the allied woolen industry it was only 117 horsepower. The average size of the unit in the smelting and refining of copper was 192; in the paper and wood pulp industry, 149; in flour and grist mills, 72; and in the manufacture of lumber and timber products, 58 horsepower.

In an era of building, which has witnessed the rapid development of construction by means of reinforced concrete, the great importance of the cement industry is indicated by the fact that the average capacity of steam units was 215 horsepower in the manufacture of cement, thus placing it next to steel works and rolling mills in average size of engines required. At the other end of the scale in the group of industries employing 50,000 horsepower and over is to be found the printing and publishing industry, the book and job branch of which employed engines whose average capacity was only 38 horsepower, while in that branch of the business including newspapers and periodicals the average fell to 26 horsepower. The influence of electrical distribution, however, is to be noticed here, in the fact that in the book and job branch the electric motors are more than three times as numerous as the steam engines, while the rented electric power is almost twice as great as the capacity of steam engines installed on the premises. It is obvious, therefore, that but for the intervention of the electric motor the steam engines would necessarily be of much greater capacity, and it is particularly in connection with such industries requiring minute and subdivided power that the electric motor has made greatest headway in comparison with steam.

Another aspect under which the use of steampower in manufactures may be regarded is that dealing with the average amount of power per establishment. In Table 1 it is shown that the total number of establishments reporting the use of power is 134,544, with a total of 14,641,544 horsepower. This gives an average of 108.8 horsepower per establishment. The iron and steel industry depends almost entirely upon steam for its power, and according to Table 14 of the Report on Manufactures, Part I, 189 blast furnaces reported a total of 825,749 horsepower at the census of 1905. This gives the high average of 4,369 horsepower per establishment. In like manner 413 steel works and rolling mills reported a total capacity of 1,896,759 horsepower, or 4,593 horsepower per establishment. Paper and wood pulp and cotton mills, on the other hand, are large users of waterpower. The 761 paper and wood pulp mills reported a total of 1,122,564 horsepower, which gives an average of 1,475 horsepower per establishment, while 1,073 mills devoted to cotton goods had a total of 1,031,843 horsepower, or 962 horsepower per establishment.

The Report on Power Employed in Manufactures, at the census of 1900, was accompanied by considerable data with regard to steam engines and steam turbines, emphasizing the marked tendency toward the adoption of larger units, and dwelling with special stress upon the important advances being realized in the perfecting of the modern steam turbine. At that time two principal types of turbines were in use in the manufacturing field in the United States, namely, the De Laval and the Parsons, both of foreign origin. The general principle of the turbine designed by the Swede, De Laval, is that of a single disk with several steam jets or nozzles applied to it, the nozzle having a divergent aperture in which the expansion of steam takes place. A single turbine disk revolves at a speed of several thousand revolutions per minute, this speed being reduced to that required for the main shaft by spiral gears. Turbines of this type have been applied in the manufacturing industries up to a capacity of 350 horsepower. At this point the Englishman, Parsons, stepped in with a type of turbine in which a series of disks mounted upon a common shaft alternate with parallel plates fixed within the casing of the shaft. The steam, admitted through a set of stationary vanes or buckets, impinges at an angle upon the first rotating disk and imparts motion in expanding, as it advances progressively, through the entire series of fixed and rotating buckets until its energy has been given up and it emerges into the exhaust. With horizontal turbines of this type the capacity of the unit has been carried up to several thousand horsepower, so that in this country one company building turbines of this type has introduced machines of a capacity as great as 10,000 horsepower or more. Intended to drive electric

generators, these turbines occupy a floor space of only 27 feet 27 inches by 13 feet 1½ inches, while the dimensions are only 47 feet 3 inches by 13 feet 1½ inches for the complete turbo-generator unit. Up to the beginning of 1904 a total production of not less than 700,000 horsepower of Parsons turbines had been recorded, including single installations of 10,000 horsepower, many of which were for manufacturing industries, and while these statistics have been in process of compilation, this total has been at least doubled. In the meantime a large number of other steam turbine manufacturers have also entered this promising field, both in Europe and in the United States, so that the turbine has ceased to be in any sense a novelty, and is now being closely watched and tested as to its durability and economic performance, both on land and on sea.

In the United States the most typical development is that which has been made with the Curtis turbine, which also makes use of the velocity of steam relieved of its pressure in the expansion nozzles at successive stages. Aside from the internal construction of stationary and revolving parts, a notable feature of the Curtis turbine has been the adoption of a vertical shaft, although in some smaller sizes the turbine is operated horizontally. The larger sizes are more particularly those furnished for the operation of dynamos, with the electrical generating portion carried vertically above the turbine. These have a capacity of 12,000 to 15,000 horsepower. One company which manufactures the turbines of this type, in its annual report for the year 1904, listed contracts for 154 steam turbines for 86 corporations and individuals, while a year later it was stated that orders had been received for no fewer than 535. As a great many of these have a capacity in excess of 1,000 horsepower and in the case of some industrial manufacturing and electrical establishments have reached a capacity of 5,000 horsepower and upward, the extent of the revolution in the utilization of steam caused by the introduction of the turbine can readily be imagined. It will, however, be some little time before all the economy claimed for the turbine in the matter of steam consumption, wear and tear, labor, attendance, and space occupied can be fully and accurately determined or established.

WATERPOWER.

Table 8 presents statistics of waterpower used in the states and territories as returned at each census from 1870 to 1905, with the amount and percentage of increase.

The total for 1905 was 1,647,969 horsepower, as compared with 1,454,229 horsepower in 1900, showing an increase of 193,740 horsepower and a percentage of increase of 13.3. The amount of gain was almost the same as that during the ten years from 1890 to 1900, when the percentage of increase was 15.1. Waterpower has not held its own but has steadily declined in relative importance since 1870, when it was 48.2 per cent of the whole, whereas for 1905 it was only 11.3 per cent. The warning previously given, must be borne in mind, that the statistics, while accurate, can hardly be accepted as revealing the actual state of affairs, owing to the fact that an increasing quantity of energy developed by waterpower is transmitted and utilized electrically, so that it is reported as electric power by manufacturing establishments.

The largest amount of waterpower used in manufactures at the census of 1905 was reported by the state of New York. The capacity in that state had increased from 335,411 horsepower for 1900 to 446,134 horsepower for 1905, a gain of considerably over 100,000 horsepower, and giving the state 27.1 per cent of the total for the whole country. The continued preponderance of New York in the use of waterpower is due largely to the utilization of, and the increase in, this kind of power in the paper and wood pulp industry, which increased from 191,117 horsepower in 1900 to 325,472 horsepower at the census of 1905. At both censuses waterpower formed over 80 per cent of the total power reported by this industry in the state. Of the total waterpower reported by New York in 1900 paper and wood pulp manufacturers used 57 per cent; at the census of 1905 the ratio had increased to 73 per cent.

The next largest utilization of waterpower in manufactures was reported by the state of Maine with 203,094 horsepower, followed closely by Massachusetts with 183,427 horsepower. The former state reflects the development of the utilization in the paper and wood pulp and cotton industries, and it is significant that, although the lumber industry is a large consumer of waterpower in Maine, the amount reported for 1905 was a decrease of 19.3 per cent since 1900. Massachusetts, as is well known, largely consumed this class of energy in the manufacture of paper and textile products, the latter chiefly cotton and wool. The fourth largest utilization on the list is that reported from Wisconsin, with 112,665 horsepower. Here again the paper and wood pulp industry accounted for a large proportion of the total amount, with flour and grist mills as the next largest consumer. In Wisconsin, as in Maine and in New York, the paper and wood pulp industry is the largest factor in waterpower employment, while in Massachusetts the cotton and wool industries are the largest.

The 4 states mentioned above accounted for 945,320 horsepower, or considerably more than one-half (57.4 per cent) of the total for the country. Other leading states were Vermont, with 76,237 horsepower; Connecticut, 66,808; Pennsylvania, 50,620; Michigan, 39,342; and Minnesota, 38,245. It is to be noted that California returned the small figure of 7,260 horsepower,

placing it far down the list, whereas, as a matter of fact, that state has witnessed perhaps more than any other of recent years the development of the waterpower of its sierras and rivers for long distance transmission, the hydraulic energy thus utilized serving mills and mines and factories all over the state.

As might be expected, in some of the states and territories where the aggregate of waterpower is least, the percentage of increase has been greatest, as the addition of a few hundred horsepower has been enough to double the capacity, but it is worthy of note that the increase in New York from 1900 to 1905 was 33 per cent; in Maine, 27.9 per cent; and in Wisconsin, 21 per cent. The development in Massachusetts was virtually at a standstill, and the same was true of Connecticut and Vermont, there being visible a tendency toward retrogression in certain parts of the New England region. It would indeed be an interesting study to determine how far the greater use of steam in some of the industries of the Northern states is due to the fact that the waterpowers have possibly been already developed to their full capacity.

Table 8.—WATERPOWER, WITH AMOUNT AND PER CENT OF INCREASE, BY STATES AND TERRITORIES: 1870 TO 1905.

[For 1900 the horsepower includes the hand trades and neighborhood industries, except custom gristmills, custom sawmills, and cotton ginning. Prior to 1900 the horsepower includes all hand trades and neighborhood industries.]

STATE OR TERRITORY.	HORSEPOWER.[1]					INCREASE.							
	1905	1900	1890	1880	1870	1900 to 1905		1890 to 1900		1880 to 1890		1870 to 1880	
						Amount.	Per cent.	Amount.	Per cent.	Amount.	Per cent.	Amount.	Per cent.
United States	1,647,969	1,454,229	1,263,343	1,225,379	1,130,431	193,740	13.3	190,886	15.1	37,964	3.1	94,948	8.4
Alabama	9,518	9,421	10,443	11,797	11,011	97	1.0	[2] 1,022	[2] 9.8	[2] 1,354	[2] 11.5	786	7.1
Alaska	89	117	161			[2] 28	[2] 23.9	[2] 44	[2] 27.3	161			
Arizona	267	400	329	160	10	[2] 133	[2] 33.3	71	21.6	169	105.6	150	1,500.0
Arkansas	584	734	1,778	2,024	1,545	[2] 150	[2] 20.4	[2] 1,044	[2] 58.7	[2] 246	[2] 12.2	479	31.0
California	7,260	4,680	5,122	4,850	6,877	2,580	55.1	[2] 442	[2] 8.6	272	5.6	[2] 2,027	[2] 29.5
Colorado	2,094	1,493	1,740	1,849	792	601	40.3	[2] 247	[2] 14.2	[2] 109	[2] 5.9	1,057	133.5
Connecticut	66,808	67,211	64,655	61,205	54,395	[2] 403	[2] 0.6	2,556	4.0	3,450	5.6	6,810	12.5
Dakota	(3)	(3)	(3)	803	76					789	98.3	727	956.6
Delaware	5,280	5,399	4,671	4,785	4,220	[2] 119	[2] 2.2	728	15.6	[2] 114	[2] 2.4	565	13.4
District of Columbia	710	369	810	880	1,100	341	92.4	[2] 441	[2] 54.4	[2] 70	[2] 8.0	[2] 220	[2] 20.0
Florida	118	116	496	939	528	2	1.7	[2] 380	[2] 76.6	[2] 443	[2] 47.2	411	77.8
Georgia	28,304	22,729	28,390	30,067	27,417	5,575	24.5	[2] 5,661	[2] 19.9	[2] 1,677	[2] 5.6	2,650	9.7
Idaho	1,078	1,605	1,024	1,136	295	[2] 527	[2] 32.8	581	56.7	[2] 112	[2] 9.9	841	285.1
Illinois	15,030	11,614	16,124	17,445	12,953	3,416	29.4	[2] 4,510	[2] 28.0	[2] 1,321	[2] 7.6	4,492	34.7
Indian Territory	59	155	75			[2] 96	[2] 61.9	80	106.7	75			
Indiana	9,685	11,964	16,305	21,810	23,518	[2] 2,279	[2] 19.0	[2] 4,341	[2] 26.6	[2] 5,505	[2] 25.2	[2] 1,708	[2] 7.3
Iowa	6,531	7,315	12,645	20,363	14,249	[2] 784	[2] 10.7	[2] 5,330	[2] 42.2	[2] 7,718	[2] 37.9	6,114	42.9
Kansas	6,544	7,521	7,764	7,611	1,789	[2] 977	[2] 13.0	[2] 243	[2] 3.1	153	2.0	5,822	325.4
Kentucky	4,603	4,247	6,272	9,012	7,640	356	8.4	[2] 2,025	[2] 32.3	[2] 2,740	[2] 30.4	1,372	18.0
Louisiana	266	313	66	90	142	[2] 47	[2] 15.0	247	374.2	[2] 24	[2] 26.7	[2] 52	[2] 36.6
Maine	203,094	158,788	106,520	79,717	70,108	44,306	27.9	52,268	49.1	26,803	33.6	9,609	13.7
Maryland	10,777	10,415	15,633	18,043	18,461	362	3.5	[2] 5,218	[2] 33.4	[2] 2,410	[2] 13.4	[2] 418	[2] 2.3
Massachusetts	183,427	181,907	159,787	138,362	105,854	1,520	0.8	22,120	13.8	21,425	15.5	32,508	30.7
Michigan	39,342	36,529	39,181	34,395	34,895	2,813	7.7	[2] 2,652	[2] 6.8	4,786	13.9	[2] 500	[2] 1.4
Minnesota	38,245	24,932	27,404	28,689	13,054	13,313	53.4	[2] 2,472	[2] 9.0	[2] 1,285	[2] 4.5	15,635	119.8
Mississippi	77	361	2,752	3,449	2,453	[2] 284	[2] 78.7	[2] 2,391	[2] 86.9	[2] 697	[2] 20.2	996	40.6
Missouri	3,727	3,113	4,758	8,162	6,644	614	19.7	[2] 1,645	[2] 34.6	[2] 3,404	[2] 41.7	1,518	22.9
Montana	10,315	9,717	666	954	795	598	6.2	9,051	1,359.0	[2] 288	[2] 30.2	159	20.0
Nebraska	7,221	7,513	6,127	5,495	1,446	[2] 292	[2] 3.9	1,386	22.6	632	11.5	4,049	280.0
Nevada	782	893	6	108	2,538	[2] 111	[2] 12.4	887	14,783.3	[2] 102	[2] 94.4	[2] 2,430	[2] 95.7
New Hampshire	100,274	105,711	69,033	69,155	68,291	[2] 5,437	[2] 5.1	36,678	53.1	[2] 122	[2] 0.2	864	1.3
New Jersey	18,197	20,161	17,645	27,066	25,832	[2] 1,964	[2] 9.7	2,516	14.3	[2] 9,421	[2] 34.8	1,234	4.8
New Mexico	149	153	323	932	659	[2] 4	[2] 2.6	[2] 170	[2] 52.6	[2] 609	[2] 65.3	273	41.4
New York	446,134	335,411	233,795	219,348	208,256	110,723	33.0	101,616	43.5	14,447	6.6	11,092	5.3
North Carolina	28,382	29,241	31,817	30,063	26,211	[2] 859	[2] 2.9	[2] 2,576	[2] 8.1	1,754	5.8	3,852	14.7
North Dakota	322	506	540	(4)	(4)	[2] 184	[2] 36.4	[2] 34	[2] 6.3				
Ohio	18,149	17,848	27,683	38,641	44,746	301	1.7	[2] 9,835	[2] 35.5	[2] 10,958	[2] 28.4	[2] 6,105	[2] 13.6
Oklahoma	50	1				49	4,900.0	1					
Oregon	20,660	19,263	9,469	9,255	5,806	1,397	7.3	9,794	103.4	214	2.3	3,449	59.4
Pennsylvania	50,620	54,601	82,534	110,276	141,982	[2] 3,981	[2] 7.3	[2] 27,933	[2] 33.8	[2] 27,742	[2] 25.2	[2] 31,706	[2] 22.3
Rhode Island	29,231	28,171	27,258	22,240	18,481	1,060	3.8	913	3.3	5,018	22.6	3,759	20.3
South Carolina	31,097	27,586	16,399	13,873	10,395	3,511	12.7	11,187	68.2	2,526	18.2	3,478	33.5
South Dakota	1,069	1,099	1,052	(4)	(4)	[2] 30	[2] 2.7	47	4.5				
Tennessee	9,995	11,078	15,477	18,564	19,514	[2] 1,083	[2] 9.8	[2] 4,399	[2] 28.4	[2] 3,087	[2] 16.6	[2] 950	[2] 4.9
Texas	2,277	1,557	2,633	2,508	1,830	720	46.2	[2] 1,076	[2] 40.9	125	5.0	678	37.1
Utah	3,252	3,366	2,492	3,535	2,169	[2] 114	[2] 3.4	874	35.1	[2] 1,043	[2] 29.5	1,366	63.0
Vermont	76,237	77,421	74,376	52,226	44,897	[2] 1,184	[2] 1.5	3,045	4.1	22,150	42.4	7,329	16.3
Virginia	25,946	23,550	36,663	37,464	41,202	2,396	10.2	[2] 13,113	[2] 35.8	[2] 801	[2] 2.1	[2] 3,738	[2] 9.1
Washington	4,642	6,853	4,851	1,185	1,412	[2] 2,211	[2] 32.3	2,002	41.3	3,666	309.4	[2] 227	[2] 16.1
West Virginia	6,404	5,425	10,542	9,454	10,195	979	18.0	[2] 5,117	[2] 48.5	1,088	11.5	[2] 741	[2] 7.3
Wisconsin	112,665	93,122	56,841	45,356	33,714	19,543	21.0	36,281	63.8	11,485	25.3	11,642	34.5
Wyoming	382	534	216	38	34	[2] 152	[2] 28.5	318	147.2	178	468.4	4	11.8

[1] For 1890 the horsepower represents owned and rented power. At subsequent censuses rented power was not segregated as to waterpower; the totals therefore represent owned power only.
[2] Decrease.
[3] See North Dakota and South Dakota.
[4] See Dakota.

The chief industries reporting the use of waterpower at the census of 1905 are those of cotton goods, with 1,218 water wheels of a capacity of 251,884 horsepower; flour and grist mills, 7,261 water wheels, with 258,111 horsepower; lumber and timber products, 2,496 wheels, with 103,657 horsepower; and paper and wood pulp, 3,149 wheels, with 717,979 horsepower. Worthy of note is the fact that the last-named industry alone accounts for nearly one-half of the waterpower used in the manufactures of the country. Another relatively large field of utilization is that of the woolen goods industry, in which 765 wheels are reported, with a capacity of 55,931 horsepower. In these industries, as with steam utilization, the size of water wheel depends largely upon the nature of the product. For example, in the flour and grist mill industry the average size of wheel was 36 horsepower. In the lumber industry the average was 42 horsepower. In the industry of cotton goods it rose to 207 horsepower per wheel, and in paper and wood pulp it attained a size of 228 horsepower. Even these figures are exceeded in several instances. For example, in the paper and wood pulp industry the 7 wheels employed in California are reported as having a capacity of 3,000 horsepower, or 429 horsepower each, while in West Virginia the 3 wheels reported had a capacity of 1,310 horsepower, or 437 horsepower each.

It is evident, therefore, that the capacity of individual units will far exceed the average in any industry or for the country as a whole, but it is again to the electrical transmission field that one must look for the striking examples. For instance, the Seattle-Tacoma Power Company at its Snoqualmie Falls plant has installed a "single wheel" turbine of 10,000 horsepower capacity, which is the largest turbine of its type ever built. Around Niagara Falls will be found the 12,500 horsepower vertical turbines of the Electrical Development Company, the 10,000 horsepower horizontal turbines of the Ontario Power Company, and the 10,000 horsepower vertical turbines of the Canadian Niagara Falls Power Company. All of these are double wheels, as each unit has two runners and a single shaft, driving a single generator. The single wheel turbine at Snoqualmie is of a horizontal shaft type, with radial inward flow and central axial discharge. The wheel is of 66 inches outside diameter by 9½ inches wide through the vanes. It has 34 vanes, which continue a short distance inward beyond the end plate of the wheel on the discharge side, thus giving a slight axial effect and making it a turbine of the mixed flow type rather than a pure radial flow turbine. The guide vanes are 32 in number, of the swivel type, connected by means of arms projecting radially inward to a rotatory ring concentric with the turbine shaft. The housing of the turbine is built up of cast iron segments. The turbine wheel or runner is an annular steel casting whose radial depth is only enough to contain the vanes. This single wheel, at 260 feet head, is employed to develop as much energy as the entire former installation consisting of 10 impulse wheels, and under test at 84 per cent efficiency has shown an output of 10,000 horsepower. The machine weighs about 190,000 pounds, exclusive of the steel supply pipe and the draft tube.

Under the same general head of utilization of waterpower, water motors might be separately considered, but these are insignificant in number and size, and such information as is valuable or pertinent in regard to them can be obtained readily from Tables 12, 13, and 14 of the Report on Manufactures, Part I, census of 1905.

No separate statistics are given as to overshot or undershot water wheels. The discussion of generators has been treated entirely from the standpoint of turbines, as that type of hydraulic machinery has completely superseded all other classes except impact wheels. The latter still have an extensive field of use, particularly in the far western region and on the Pacific coast, where, under heads of several hundred feet and at high speeds of revolution, they are increasingly numerous and find extensive employment. At Manitou, near the Garden of the Gods, Colo., the Pikes Peak Hydro-Electric Company has three wheels operating under a static head of 2,417 feet. The plant utilizes water belonging to a city waterworks plant, a supply which was previously wasted. This plant utilizes about 2,200 feet effective head of total fall between the mountain intakes and the reservoirs, the remainder being lost in pipe friction. Another instance that may be cited is that at Bishop, Cal., of the Nevada Mining and Milling Company, where two wheels operating under a static head of 1,065 feet, and each of a capacity of 1,000 horsepower at 450 revolutions per minute, are generating and transmitting electrical energy to the Goldfield and Tonapah mining districts of Nevada.

ELECTRIC POWER.

Table 9 shows, by states, the electric horsepower, with the amount and per cent of increase, reported at the censuses of 1890, 1900, and 1905.

As previously noted, the census statistics of power contain an element of duplication, especially of electric power. When electric power is generated by a manufacturer, the horsepower of the motors reported is a duplication of the primary generators. Allowance should be made for this fact in considering the statistics of total power.

No electric power was reported until the census of 1890, when the returns included 15,569 horsepower. At the census of 1900 the capacity of owned electric power had risen to 310,661 horsepower, showing an increase for the period of nearly nineteenfold. At the census of 1905 the amount of owned electric power had risen to 1,150,891 horsepower, being 270.5 per cent increase for the five years. This service was furnished

through 73,120 motors. The full story of electrical development is brought out, however, more clearly by the subdivision of rented power. From this it would appear that while the "other kind" of rented power, which is chiefly steam and water, increased from 136,913 horsepower in 1900 to 191,313 at the census of 1905, rented electric horsepower rose from 182,562 to 441,592 horsepower. This service was furnished through 61,590 motors. If, therefore, the rented electric power be added to that owned by the manufacturing establishments, it will be seen that the total capacity of the 134,710 electric stationary motors was 1,592,483 horsepower, approximating the total returned for waterpower. The average capacity of electric motors owned was 16 horsepower, while that of motors driven by rented electric energy was only 7 horsepower.

These statistics bring out in a striking manner the notable development of the utilization of electrical energy in manufacturing, and Table 9 indicates the concentration of this motive power in the states and territories. The table includes both the owned and rented power.

TABLE 9.—ELECTRIC POWER, WITH AMOUNT AND PER CENT OF INCREASE, BY STATES AND TERRITORIES: 1890 TO 1905.

[For 1900 the horsepower includes the hand trades and neighborhood industries, except custom gristmills, custom sawmills, and cotton ginning. Prior to 1900 the horsepower includes all hand trades and neighborhood industries.]

STATE OR TERRITORY.	HORSEPOWER.[1]			INCREASE.			
				1900 to 1905		1890 to 1900	
	1905	1900	1890	Amount.	Per cent.	Amount.	Per cent.
United States	1,592,483	493,223	15,569	1,099,260	222.9	477,654	3,068.0
Alabama	10,114	3,421	51	6,693	195.6	3,370	6,607.8
Alaska	8	287	....	[2] 279	[2] 97.2	287	....
Arizona	4,821	534	....	4,287	802.8	534	....
Arkansas	2,191	480	31	1,711	356.5	449	1,448.4
California	49,575	15,762	393	33,813	214.5	15,369	3,910.7
Colorado	15,730	1,896	58	13,834	729.6	1,838	3,169.0
Connecticut	34,579	12,925	205	21,654	167.5	12,720	6,204.9
Delaware	5,764	1,870	104	3,894	208.2	1,766	1,698.1
District of Columbia	1,761	348	70	1,413	406.0	278	397.1
Florida	2,960	302	3	2,658	880.1	299	9,966.7
Georgia	15,556	2,698	157	12,858	476.6	2,541	1,618.5
Idaho	1,702	6	2	1,696	28,266.7	4	200.0
Illinois	165,265	49,235	939	116,030	235.7	48,296	5,143.3
Indian Territory	132	....	....	132	....	....	....
Indiana	33,582	7,903	323	25,679	324.9	7,580	2,346.7
Iowa	8,663	6,222	194	2,441	39.2	6,028	3,107.2
Kansas	10,326	3,426	110	6,900	201.4	3,316	3,014.5
Kentucky	10,690	3,415	100	7,275	213.0	3,315	3,315.0
Louisiana	6,752	2,069	454	4,683	226.3	1,615	355.7
Maine	26,587	9,659	191	16,928	175.3	9,468	4,957.1
Maryland	18,823	4,174	212	14,649	351.0	3,962	1,868.9
Massachusetts	91,012	32,828	2,327	58,184	177.2	30,501	1,310.7
Michigan	39,970	12,088	577	27,882	230.7	11,511	1,995.0
Minnesota	14,427	6,300	280	8,127	129.0	6,020	2,150.0
Mississippi	1,367	590	3	777	131.7	587	19,566.7
Missouri	37,671	12,725	618	24,946	196.0	12,107	1,959.1
Montana	7,979	3,184	43	4,795	150.6	3,141	7,304.7
Nebraska	8,126	2,398	49	5,728	238.9	2,349	4,793.9
Nevada	550	1	....	549	54,900.0	1	....
New Hampshire	12,301	3,471	42	8,830	254.4	3,429	8,164.3
New Jersey	69,301	15,857	487	53,444	337.0	15,370	3,156.1
New Mexico	233	8	....	225	2,812.5	8	....
New York	222,111	77,598	2,447	144,513	186.2	75,151	3,071.1
North Carolina	5,553	2,733	44	2,820	103.2	2,689	6,111.4
North Dakota	477	171	2	306	178.9	169	8,450.0
Ohio	144,467	42,157	1,705	102,310	242.7	40,452	2,372.6
Oklahoma	778	12	....	766	6,383.3	12	....
Oregon	5,223	2,690	37	2,533	94.2	2,653	7,170.3
Pennsylvania	346,797	107,746	2,162	239,051	221.9	105,584	4,883.6
Rhode Island	15,477	4,895	295	10,582	216.2	4,600	1,559.3
South Carolina	32,162	6,061	8	26,101	430.6	6,053	75,662.5
South Dakota	339	234	3	105	44.9	231	7,700.0
Tennessee	6,586	2,193	106	4,393	200.3	2,087	1,968.9
Texas	10,299	3,217	166	7,082	220.1	3,051	1,838.0
Utah	4,272	2,829	64	1,443	51.0	2,765	4,320.3
Vermont	7,238	2,173	34	5,065	233.1	2,139	6,291.2
Virginia	12,687	5,617	105	7,070	125.9	5,512	5,249.5
Washington	15,290	3,137	63	12,153	387.4	3,074	4,879.4
West Virginia	5,199	454	5	4,745	1,045.2	449	8,980.0
Wisconsin	48,878	13,137	295	35,741	272.1	12,842	4,353.2
Wyoming	132	87	5	45	51.7	82	1,640.0

[1] For 1905 and 1900 the horsepower represents owned and rented power; for 1890, owned power only.

[2] Decrease.

There was an extraordinary development from 1900 to 1905 in the states distinguished chiefly for heavy manufacturing on a large scale. In Pennsylvania the capacity rose from 107,746 to 346,797 horsepower, or 221.9 per cent. In the state of New York there was an increase in capacity from 77,598 to 222,111 horsepower, or 186.2 per cent. In Illinois the capacity rose from 49,235 to 165,265 horsepower, or 235.7 per cent. In Ohio it rose from 42,157 to 144,467 horsepower, or 242.7 per cent. In Massachusetts the capacity rose from 32,828 to 91,012 horsepower, or 177.2 per cent. The figures for New Jersey are equally striking, the capacity increasing from 15,857 to 69,301 horsepower, or 337 per cent.

In California the effect of electric energy transmission is seen especially in the fact that while "other kind" of rented horsepower actually fell off in the period from 1900 to 1905, rented electric horsepower increased from 9,624 to 39,363, the latter comprising almost 80 per cent of all electric power reported by the state. In Iowa the rented horsepower other than electric fell off from 642 horsepower to 523, but rented electric power increased from 2,613 to 5,107 horsepower. The same tendency was manifested in other states, as for instance in Maryland, where the other rented power declined from 1,650 to 1,359 horsepower, while rented electric power increased from 733 to 3,309 horsepower. South Carolina presents an extraordinary example of this encroachment of the newer motive power resulting in an entire reversal of the figures. Thus in 1900 rented electric power was only 185 and other rented power 3,320 horsepower. At the census of 1905 rented electric power in that state had increased to 8,451 horsepower and other rented power had declined to the insignificant total of 80 horsepower. A more extreme revolution it would probably be hard to find in industrial history.

Of late years the electric motor has come to be a very important factor in iron and steel works and rolling mills. At the census of 1905, 12,183 motors were employed in such mills, with a capacity of 247,460 horsepower, supplemented by 6,798 rented electric horsepower. In blast furnaces 1,370 motors were employed, with a total capacity of 52,471 horsepower, associated with 6,320 rented electric horsepower. In the manufacture of structural ironwork 2,324 motors were employed of 27,247 horsepower, supplemented by 7,327 rented electric horsepower, and 9,834 motors of 109,294 horsepower were devoted to the manufacture of foundry and machine shop products, and in addition 44,983 rented electric horsepower was used. It will be seen that these four allied iron and steel industries employed directly electric motors of a capacity of 436,472 horsepower and rented power to the extent of 65,428 horsepower, a total of 501,900 horsepower, or almost one-third of the total for all industries.

A large aggregate capacity was also employed for the construction and repair of cars, etc., by steam railroads, namely, 3,028 motors of 46,561 horsepower and 6,074 rented horsepower, and there should be added 717 motors of 14,189 horsepower, supplemented by 316 rented horsepower, employed specifically for the construction of steam cars by other than railroad companies. The industry of cotton goods employed 767 motors of 52,734 horsepower, supplemented by 13,565 rented horsepower. For the production of electrical machinery, apparatus, and supplies, 6,141 motors were employed of 40,440 horsepower, supplemented by 21,313 rented horsepower. In several instances the rented power exceeded that owned or generated by the manufacturers, and sometimes to a considerable extent. For example, for flour and grist mills 232 motors were returned of 4,724 horsepower, while the rented electric power amounted to 15,584 horsepower. In planing mills 332 motors of 4,489 horsepower were owned, but the rented electric horsepower was more than twice as great. This feature was, however, most marked in the printing and publishing industries. In the book and job printing offices 1,386 motors were employed of 4,848 horsepower, but the rented electric power was not less than 30,095 horsepower. In like manner in newspaper and periodical plants 1,531 motors were employed of 9,558 horsepower, but 39,771 horsepower was reported as rented. The printing arts lend themselves peculiarly to the subdivision of power and to the utilization of electric motors, and the business is also carried on to a great extent in populous centers, so that central station sources of supply can be drawn upon. The result is that even in great cities, such as New York, the largest newspapers have transmitted to them from distant power houses electrical energy for the propulsion of their presses and the operation of other machinery necessary to the publishing of their daily issues.

As already noted in connection with other industries, the nature of the raw material or the class of product is a factor in determining the size of the motors. The largest owned electric motors, on the average, at the census of 1905 are to be found in the cotton goods industry, with a capacity of 69 horsepower; in the paper and wood pulp industry, of 54 horsepower; in woolen goods, of 46 horsepower; and in worsted goods, of 41 horsepower. Those in blast furnaces had an average capacity of 38 horsepower and in steel works and rolling mills of 20 horsepower; from this the size dwindles down to those employed in book and job printing offices, with an average of slightly less than $3\frac{1}{2}$ horsepower. It should not be understood, however, that these are other than average figures, as motors of very large capacity, far in excess of those usually employed in the cotton industry, are being applied to rolling mill and blast furnace purposes. For example, motors of 1,500 horsepower capacity at a speed of 100 revolutions per minute, and capable of being driven far beyond this point, have been installed in a large rolling mill; and motors of 1,200 horsepower have been installed for reversing rolls, while

1,500 horsepower motors have also been applied to blooming mills.

The use of electric motors is now so general that it is difficult to name any industry, manufacturing or otherwise, to which this modern mechanism has not been applied. The figures cited above are a sufficient indication of the remarkably rapid adoption of electric power that is going on, but the economies due to the change from long and short lines of belt shafting to the application of power directly at the point of utilization by the motor have not yet been fully worked out or realized in practice. There is hardly a class of machine tools which is not to-day in a transitional stage, owing to the efforts that are being made not only to abandon the line shafting but to build the electric motors directly into the tool or appliance itself. In fact, this principle of direct application or minute subdivision of applied power has gone so far that several motors are now being fitted or applied directly to the one tool or piece of apparatus, each motor being limited to its own specific function in raising or lowering, turning or reversing, etc. It may be safely asserted that practically all the newer factories and shops in the United States of any size, constructed within the past five years, have an electrical drive either exclusively or for most purposes. In some instances the motors have been applied directly to the tools, and in others one motor drives a constant speed countershaft from which the separate machines receive their power through leather belts or special forms of link belt drives. As between direct connected and belted motors, it is a question of the interbalancing of advantages—the capital outlay being less where the large shaft-driving motors are employed, while the energy consumption is also reduced by their higher efficiency. On the other hand, the incorporation of the motor directly into the machine drive through gears or short link belts without intermediate shaft belting is found to offer many advantages, and there is a constant effort in this direction of simplicity of drive on the part of both machine builders and the manufacturers of motors. The general advantages due to the adoption of electric power are common to both methods and are those connected with economy, the greater flexibility and handiness, the lessening of risk of total breakdown, and the generally greater refinement of speed or delicacy of operation.

Reference has been made to the subject of electric energy transmission, and a tabular statement is presented giving a list of some of the most important and interesting electrical transmission plants on the American continent.

Electrical transmission plants.

NAME.	Location.	Maximum transmitting voltage.	Total capacity, horsepower.	Frequency of cycles.	Length of line (miles).
Edison Electric Company, Kern River Station	Los Angeles, Cal	75,000	26,000	50	139
American River Electric Company	Placerville, Cal	60,000	4,000	60	90
Northern California Power Company	Redding, Cal	22,000	7,000	60	60
California Gas and Electric Company	San Francisco, Cal	70,000	60,000	60	100 to 200
Siskiyou Electric Power Company	Yreka, Cal	22,500	22,500	60	9
Electric Development Company	Colorado	60,000	37,000	25	90
Animas Canal Reduction Water Power and Development Company	Durango, Colo	50,000	24,000	60	55
Atlanta Water and Electric Power Company	Morgan Falls, Ga	22,000	14,000	25	5
Great Northern Power Company	Duluth, Minn	60,000	60,000	25	14
Columbia Improvement Company	Taylors Falls, Minn	50,000	13,500	60	38
Spring River Power Company	Joplin, Mo	33,000	4,000	60	28
Missouri River Power Company	Canyon Ferry, Mont	55,000	10,000	60	65
Missouri River Power Company	Helena, Mont	60,000	5,000	60	60
Cataract Power and Conduit Company	Niagara Falls, N. Y	22,000	50,000	25	25
Ontario Power Company	Niagara Falls, N. Y	60,000	70,000	25	185
Whitney Reduction Company	Salisbury, N. C	60,000	35,000	60	75
Condor Water and Power Company	Tolo, Oreg	22,000	1,000	60	100
Juniata Hydro-Electric Company	Huntingdon, Pa	45,000	7,500	60	30
Belton Power Company	South Carolina	22,500	5,000	60	14
Telluride Power Transmission Company	Provo, Utah	40,000	12,000	60	55
Utah Sugar Company	Salt Lake City, Utah	23,000	3,000	60	9
Nooksack Falls Power Company	Myrtle Falls, Wash	38,000	2,000	60	40
Washington Water Power Company	Post Falls, Wash	60,000	24,000	60	110
Columbus Improvement Company	Seattle, Wash	55,000	28,700	60	47
Puget Sound Power Company	Seattle, Wash	52,000	35,000	60	47
Seattle-Tacoma Power Company	Snoqualmie, Wash	33,000	14,700	60	4
Madison River Power Company	Wisconsin	80,000	24,000	60	60
Foreign.					
Mexican Light and Power Company	City of Mexico	60,000	40,000	50	173
Hamilton Cataract Power and Light Company	Hamilton, Ontario	45,000	30,400	66	36
Shawinigan Water and Power Company	Montreal, Canada	50,000	20,000	30	80
Shawinigan Power Company	Montreal, Canada	56,000	15,000	25	85
Canadian Niagara Falls Power Company	Niagara Falls	60,000	70,000	25	90
Niagara, Lockport, and Ontario Company	Niagara Falls, N. Y	60,000	40,000	25	168
Winnipeg General Power Company	Winnipeg, Manitoba	60,000	25,000	60	67

As will be seen from this statement, several of these lines are over 100 miles in length, and in one instance, in California, the total length of line is now 200 miles. It will also be observed that the total capacity of these plants ranges upward in many instances to 50,000, 60,000, and 70,000 horsepower. The line

voltage which not long ago electrical engineers were reluctant to carry above 10,000 volts now reaches, as is shown by the table, 40,000, 60,000, and 80,000 volts, and pressures are under discussion which range even higher than this. It is from such plants as these that a large amount of the rented electric power referred to above is derived, as well as from the central station power plants in cities and towns. All the plants enumerated in the above statement are based upon the utilization and conversion of hydraulic energy and its transmission and distribution in the shape of electrical energy. At the same time it will be observed that but for the adoption of electrical methods it would have been found impossible to develop advantageously many of these waterpowers hitherto running to waste. Electricity has conferred a double benefit not only in saving that which was hitherto lost, but in enabling manufacturers and miners to locate at points where their processes can be carried on with greatest economy and profit and to employ there power which would otherwise have been beyond their reach or beyond their resources. The effect of this electrical revolution can not yet be fully apprehended, as it is in its earlier stages; but there can be no doubt as to the profound impression that it is making upon every branch of industry, including all the departments of manufacture.

The utilization of waterpower through long distance transmission lines and with the aid of electric motors for manufacturing and kindred purposes is intimately associated with the question of coal output and the general exhaustion of the fuel supplies. This exhaustion, while not imminent, has already made its possible ultimate effects felt in the gradual increase in the cost of natural gas and petroleum and in the steady increase in the cost of coal, which necessarily becomes more expensive as it is more difficult to mine at lower depths. The resort, therefore, to remote waterpowers and to the intervention of electric motors was in a sense inevitable and explains the eagerness with which water privileges, falls, and river courses are being acquired and developed throughout the country for the purposes of electrical transmission. Another aspect of the case is the strictly economic one. It is undoubtedly a fact that the use of waterpower in this manner has greatly lessened power costs in manufacturing. Taking the electrical utilization of Niagara as a basis, although the power development there is neither the dearest nor the cheapest, it is found that the industries at that point are paying not to exceed $25 per horsepower for a continuous year's service of 8,760 hours. The anxiety to seize upon the resources of Niagara, estimated at a total power of 4,000,000 horsepower, may therefore be understood. The utilization of one-half of this power, namely, 2,000,000 horsepower, would effect an annual saving of 12,000,000 tons of coal. Upon the basis of 3,000 hours per annum, taking the value of this fuel at $2.50 per ton, the saving effected would amount to $30,000,000. Considering this to represent 40 per cent of the cost of development annually of 2,000,000 horsepower by steam, the total expense is found to be $75,000,000.[1] Such figures as these, applied in a general way to the entire hydro-electrical development now so actively in progress throughout the country, give a rough idea of the rewards to capital and the economies to manufacturers involved in this industrial and engineering change of methods.

GAS ENGINE POWER.

The increase in the number, size, and total capacity of gas and gasoline engines has been another marked feature of industrial and engineering development in connection with manufactures. Table 10 presents the statistics of this form of power, by states, from 1890 to 1905.

The number of gas and gasoline engines increased from 14,334 in 1900 to 21,525 at the census of 1905, their capacity from 134,742 horsepower to 289,514, and their percentage of the total horsepower employed in manufacturing establishments rose from 1.3 to 2. When it is recalled that at the census of 1890 the capacity of gas engines in manufacturing establishments was only 8,930 horsepower and is now over thirty times greater, it will be seen that a really remarkable change has taken place. The percentage of gain in horsepower from 1900 to 1905 was 114.9, and this was exceeded only by the percentage of gain in electric power.

The internal combustion engine has evidently not only retained its popularity for reasons of convenience, economy, and efficiency, but has gained ground, and is to-day taken very seriously as a source of motive power on a large scale. The average size of gas engines in 1900 was 9.4 horsepower, whereas at the census of 1905 it had increased to nearly 13.5 horsepower. This gain in size, however, should not be taken to mean that the number of small gas engines is less than it was, as it is in the very small sizes that this appliance still experiences its greatest demand. The statistics are influenced very considerably by the utilization on a large scale of producer gas in connection with the iron and steel industries. In such industries, however, as printing and publishing, gas engines of an extremely small capacity are used. In the book and job branch there were 1,001 engines of a capacity of 6,136 horsepower reported at the census of 1905, or an average of 6 horsepower per engine. In the newspaper and periodical department the average was even less, as the 5,147 gas engines used had a capacity of only

[1] These figures appeared in a statement made by Mr. W. J. Clark to the Hon. T. E. Burton, chairman of the House Committee on Rivers and Harbors, during a discussion of the Niagara power bill in 1906.

18,137 horsepower, or less than 4 horsepower per unit. As a matter of fact, it is in the gas and gasoline engines that one finds to-day perhaps the widest range in size among motive power appliances, unless the electric dynamo and the electric motor be considered as generically and essentially the same.

The use of gas and gasoline power is very general throughout the country, as it is found in every state and territory. Pennsylvania was the most conspicuous state in this respect at the census of 1905, with 68,209 horsepower capacity. In New York there was a capacity of 44,288 horsepower; in Ohio, of 35,101 horsepower; in Indiana, of 21,171 horsepower; in Illinois, of 12,319 horsepower; in Wisconsin, of 11,356 horsepower; and in Michigan, of 10,534 horsepower.

The gasoline engine is necessarily more widely used than the gas engine, gasoline being obtainable everywhere, while the gas engine usually depends upon its supply of fuel from city gas works. Hence by far the larger number of gas engines, and those small ones, are to be found in the denser centers of population, where the engine can be employed for the countless minor or finer branches of industry. Unlike the steam engine, it can be installed practically on any floor of a building when surrounded by appropriate safeguards against fire. It is in this respect, however, that of recent years the smaller gas engine has encountered the sharp competition of the electric motor. The latter, in many of the essentials of convenience, economy, adaptability, and freedom from danger, comes into competition with the gas engine as does that appliance with the steam engine.

TABLE 10.—GAS AND GASOLINE POWER, WITH AMOUNT AND PER CENT OF INCREASE, BY STATES AND TERRITORIES: 1890 TO 1905.

[For 1900 the horsepower includes the hand trades and neighborhood industries, except custom gristmills, custom sawmills, and cotton ginning. Prior to 1900 the horsepower includes all hand trades and neighborhood industries.]

STATE OR TERRITORY.	HORSEPOWER.[1]			INCREASE.			
				1900 to 1905		1890 to 1900	
	1905	1900	1890	Amount.	Per cent.	Amount.	Per cent.
United States	289,514	134,742	8,930	154,772	114.9	125,812	1,408.9
Alabama	472	376	14	96	25.5	362	2,585.7
Alaska	91			91			
Arizona	1,392	371		1,021	275.2	371	
Arkansas	482	326	7	156	47.9	319	4,557.1
California	6,292	3,244	361	3,048	94.0	2,883	798.6
Colorado	317	519	36	[2] 202	[2] 38.9	483	1,341.7
Connecticut	3,393	1,608	215	1,785	111.0	1,393	647.9
Delaware	412	315	80	97	30.8	235	293.8
District of Columbia	311	338	91	[2] 27	[2] 8.0	247	271.4
Florida	320	173	63	147	85.0	110	174.6
Georgia	632	365	119	267	73.2	246	206.7
Idaho	127	28		99	353.6	28	
Illinois	12,319	8,758	708	3,561	40.7	8,050	1,137.0
Indian Territory	283	45		238	528.9	45	
Indiana	21,171	12,295	176	8,876	72.2	12,119	6,885.8
Iowa	4,486	4,524	70	[2] 38	[2] 0.8	4,454	6,362.9
Kansas	6,923	2,530	77	4,393	173.6	2,453	3,185.7
Kentucky	1,938	1,096	223	842	76.8	873	391.5
Louisiana	961	462	213	499	108.0	249	116.9
Maine	3,063	2,178	10	885	40.6	2,168	21,680.0
Maryland	4,377	3,139	175	1,238	39.4	2,964	1,693.7
Massachusetts	7,487	4,074	289	3,413	83.8	3,785	1,309.7
Michigan	10,534	5,603	237	4,931	88.0	5,366	2,264.1
Minnesota	4,710	3,624	126	1,086	30.0	3,498	2,776.2
Mississippi	220	144	8	76	52.8	136	1,700.0
Missouri	4,960	3,279	457	1,681	51.3	2,822	617.5
Montana	74	85	17	[2] 11	[2] 12.9	68	400.0
Nebraska	2,035	1,919	58	116	6.0	1,861	3,208.6
Nevada	125	39	48	86	220.5	[2] 9	[2] 18.8
New Hampshire	1,395	571	3	824	144.3	568	18,933.3
New Jersey	9,070	3,284	135	5,786	176.2	3,149	2,332.6
New Mexico	114	64		50	78.1	64	
New York	44,288	16,221	1,990	28,067	173.0	14,231	715.1
North Carolina	2,102	388	42	1,714	441.8	346	823.8
North Dakota	645	759	12	[2] 114	[2] 15.0	747	6,225.0
Ohio	35,101	14,230	1,183	20,871	146.7	13,047	1,102.9
Oklahoma	706	155		551	355.5	155	
Oregon	371	195	2	176	90.3	193	9,650.0
Pennsylvania	68,209	26,246	919	41,963	159.9	25,327	2,755.9
Rhode Island	1,247	427	18	820	192.0	409	2,272.2
South Carolina	239	323	97	[2] 84	[2] 26.0	226	233.0
South Dakota	1,397	1,270	32	127	10.0	1,238	3,868.8
Tennessee	1,084	593	54	491	82.8	539	998.1
Texas	1,876	968	157	908	93.8	811	516.6
Utah	59	89	10	[2] 30	[2] 33.7	79	790.0
Vermont	1,483	1,120	10	363	32.4	1,110	11,100.0
Virginia	1,715	748	78	967	129.3	670	859.0
Washington	493	189	3	304	160.8	186	6,200.0
West Virginia	6,569	1,045	33	5,524	528.6	1,012	3,066.7
Wisconsin	11,356	4,358	274	6,998	160.6	4,084	1,490.5
Wyoming	88	42		46	109.5	42	

[1] Represents owned power only.

[2] Decrease.

The size of gas engine units depends, as with other motive powers, to some extent upon the nature of the industry to which its power is furnished. The size of the unit in the printing and publishing industries shows a capacity of from 4 to 6 horsepower. In the manufacture of cement, however, while only 25 engines were reported at the census of 1905, their average capacity was over 122 horsepower. In blast furnaces only 27 were reported, but their capacity reached nearly 139 horsepower each, while in steel works and rolling mills 53 were installed, with a capacity of 11,806 horsepower, or an average of not less than 223 horsepower per unit. In reality, however, the gas engine with which the public is still most familiar in connection with motive power purposes is the small type connected to city gas mains. One interesting feature of the consolidation of gas and electric lighting supply companies has been the change in method of utilization. The very small gas engines may have been displaced in many instances by the electric motor, but the productive gas capacity thus set free has in turn been utilized again at the central plant to drive large gas engines attached to the dynamos. The latter furnish current to the small electric motors, thus accomplishing the same work that the small gas engines did previously. In some of these systems, natural fuel gas is also employed, an interesting example of which is seen in the gas engine plant of a street railway system in Pennsylvania. With a capacity of 1,000 horsepower this plant utilizes, at a pressure of 125 pounds, gas which is furnished by 32 wells lying in the famous Bradford sand strata of Elk county. In view of its apparent tendency, however, to diminish in volume and pressure, the natural gas supply can not be regarded as a permanent basis for the development of larger types of gas engines for manufacturing and other purposes. Thus a great deal of activity and a large amount of inventive ability are being applied to the development and perfection of gas "producer" plants. It is stated that anthracite producers for the supply of gas to such engines have already reached a high degree of perfection, are reasonable in price, simple to operate, and show an efficiency 75 to 80 per cent above that of the best steam boiler and furnace. The bituminous producer has not yet been completely worked out. In this type the volatiles are completely converted into fixed gases without serious loss and without complication of the operating system. A number of excellent appliances are already on the market for reducing bituminous coal, but when the gas is to be employed in engines of this character they are associated with special and often complex cleaning apparatus, scrubbers, and the like, for the purpose of purification before the gas is admitted to the combustion chamber. Generally the bituminous producers are of lower efficiency than the anthracite, but even existing types are reported to reach or even exceed 70 per cent efficiency, equaling that of the best steam boiler and furnace.

One of the most notable developments of the last few years in connection with the perfecting of the large gas engines has been the utilization of blast furnace gas engines. Greater economy is thus attained through the utilization of a by-product of which hitherto a very large percentage had gone to waste. A noteworthy instance of work in this direction is an equipment at Pittsburg, Pa. This plant was the first large gas power installation in America to use blast furnace gas passed through double-acting, four-cycle engines of great capacity. Support had previously been given to the internal combustion type of prime movers. But during the period of this report further interest in the subject was evidenced when the largest single operator undertook the utilization of waste gas by the purchase of 12,000 horsepower in gas driven blowing engines and 2,500 horsepower in a gas driven electrical generating unit. A new plant at Gary, Ind., comprises about 25,000 horsepower of blast furnace gas engines. A Pittsburg plant will comprise, when complete, no fewer than 12 large units for blower purposes of 3,000 horsepower each. In design these engines follow the general line of smaller units and are of the twin tandem double acting style with center hung fly wheel. Although an uninterrupted supply of air is furnished for blowing purposes, the duty imposed is by no means uniform. Owing to changes in the compactness of furnaces the air pressure must vary in proportion. The usual range is 14 to 20 pounds per square inch, except when the furnaces are tapped. At such times the pressure is reduced to 5 pounds, but when the furnaces are closely packed it may rise to 20 pounds. These variations have to be provided for by sensitive centrifugal regulators. Ordinarily compressed air is used for starting, one minute usually being sufficient, but it is worthy of note that these large units can be started and placed under full load in 53 seconds from the time of turning on the air. Since the starting is entirely automatic when the engine goes into operation, only the gas and air valves require the attention of the operator.

An explanation of the increasing favor for large gas engines in metallurgical works is furnished by Mr. R. E. Mathot, in a discussion of the subject before the American Society of Mechanical Engineers. An ordinary blast furnace of a daily 24-hour output of 100 tons of iron liberates about 315,000 cubic feet of gas, which is available for motive power and has an average value of 110 British thermal units. This volume of gas generates in steam plants about 2,500 horsepower, while in modern and improved gas engine plants it gives 4,200 horsepower. It is a difference of 1,700 horsepower, or about 70 per cent, in favor of the gas engine. The same authority asserts that among 50 smelting works in the iron and steel industry in Germany, 42 are already using or have ordered large

engines for dealing with the gas generated in the blast furnaces, smelting, or coke ovens. These works represent 350 units, with an aggregate output of about 400,000 horsepower. The largest of the plants is of 35,000 horsepower, while there are 15 works with plants of from 10,000 to 12,000 horsepower.

OTHER POWER.

Under the heading "other power," as distinguished from steam, water, gas, and electric power, Table 1 of this report includes an item of 92,154 horsepower owned. This compares with 49,985 in 1900. A large part of the power included in this group is pneumatic, although probably some hot air engines also are included. The general introduction of pneumatic tools is well known, and large pneumatic plants have been installed in various shops and factories for the purpose of supplying the compressed air delivered to these tools as their motive power. It will, of course, be understood that such compression plants involve a duplication in so far as they require association with steam or water power, or even electrical plants, in order to compress the air or insure its storage.

Aside from the use of compressed air in drilling, excavating, building operations, mining, etc., a large capacity of such apparatus is now employed directly for manufacturing purposes. As has been pointed out by Mr. Hiscox, in his well-known treatise on the subject, the use of compressed air machinery for quarrying, mining, and drilling, and the means of compressing air economically, have been greatly extended by the inventive genius of Americans, among them Rand, Ingersoll, Sergeant, Clayton, and others. Their apparatus has contributed materially to the success of the vast system of railway tunnels all over the country, as well as to the sinking and drifting in all classes of mineral excavation during the past quarter of a century. But the use of compressed air has recently invaded the field of manufactures, and tools of this type are to be found in workshops and factories of widely dissimilar character, their portable nature rendering them extremely convenient and economical. The air hammer as a riveter and drill in shipbuilding is of universal application in the United States, and its unceasing use throughout the day produces one of the characteristic noises of American shipbuilding yards. In fact, thanks to the same appliance, it might be claimed that the modern steel building is essentially a manufactured article. The pneumatic hammer is also widely in use in application to all classes of work in the machine shops. A line of air pipe is carried along the ceiling over the vice benches with the air hose attached to a hammer, while a drill stands upon the bench ready for instant use. Another application is the pneumatic fret saw, directly attached to the piston of a pneumatic hammer, and making from 1,000 to 1,800 strokes per minute. In addition to the use of this tool in wood working establishments it may be noted that it is employed in Chicago packing houses for sawing ham bones. Its application to the manufacture of fine furniture, also, is as easy and natural as the use of the pneumatic hammer in the manufacture of sculpture. Pneumatic hoists are an important class of apparatus, used either alone or associated with cranes and travelers. The application of compressed air in the manufacture of ice might be instanced, but, like other interesting work, it lies somewhat beyond the scope of this report, as does the appliance employed for dusting purposes in machine shops and railway coaches.

RENTED POWER.

Table 11 presents the statistics with regard to rented power for each census from 1890 to 1905, to which incidental reference has already been made in discussion of various motive powers.

TABLE 11.—*Rented power, by states and territories: 1890 to 1905.*

[For 1900 the horsepower includes the hand trades and neighborhood industries, except custom gristmills, custom sawmills, and cotton ginning. Prior to 1900 the horsepower includes all hand trades and neighborhood industries.]

STATE OR TERRITORY.	HORSEPOWER.		
	1905	1900	1890
United States	632,905	319,475	88,571
Alabama	1,542	721	283
Alaska	3	.....	.....
Arizona	415	38	40
Arkansas	585	256	160
California	41,885	12,230	2,593
Colorado	3,836	1,539	276
Connecticut	14,280	9,242	3,098
Delaware	1,256	1,522	104
District of Columbia	1,004	771	51
Florida	1,000	102	13
Georgia	7,762	1,940	457
Idaho	637	6	.....
Illinois	53,519	27,096	6,753
Indian Territory	105	.....	.....
Indiana	11,049	4,444	1,678
Iowa	5,630	3,255	190
Kansas	2,840	1,583	223
Kentucky	4,365	2,440	324
Louisiana	2,851	1,593	7
Maine	10,182	8,789	2,870
Maryland	4,668	2,383	979
Massachusetts	52,638	31,994	15,307
Michigan	14,816	6,385	1,983
Minnesota	9,864	4,742	1,481
Mississippi	533	502	212
Missouri	15,295	8,923	1,597
Montana	3,906	1,259	17
Nebraska	2,491	1,217	179
Nevada	835	1	.....
New Hampshire	13,745	4,426	955
New Jersey	18,912	10,102	3,562
New Mexico	268	8	10
New York	170,895	82,539	25,723
North Carolina	2,925	1,510	87
North Dakota	287	154	27
Ohio	28,902	16,614	5,880
Oklahoma	652	65	.....
Oregon	4,805	2,561	490
Pennsylvania	59,067	38,209	6,927
Rhode Island	9,457	6,691	1,911
South Carolina	8,531	3,505	74
South Dakota	191	112	.....
Tennessee	2,657	1,894	217
Texas	4,473	2,662	124
Utah	2,941	1,603	32
Vermont	5,871	3,128	844
Virginia	4,785	1,791	193
Washington	12,409	2,738	16
West Virginia	870	285	75
Wisconsin	10,424	3,838	549
Wyoming	46	7	.....

Rented power increased from 319,475 horsepower in 1900 to 632,905 horsepower for 1905, or 98.1 per cent. The total rented power was 4.3 per cent of the power of all kinds. According to the subdivided statistics this rented power for 1905 was very largely

electrical, namely 441,592 horsepower, other rented power amounting to only 191,313 horsepower. In other words, electric power was slightly more than two-thirds of the total rented horsepower.

The rented power was concentrated in the states of dense population and industrial centers, where motive power is required in small quantities for a wide range of minor industries. This fact in itself would explain the rapid increase from 88,571 horsepower in 1890 to a capacity more than seven times as great for 1905. The introduction of electric power also contributed largely to this increase. In the large cities even the more extensive manufacturing establishments find it economical to abandon the use of steam for the purposes of motive power, and in the shape of electrical energy to rent power from the local electric light and power central stations, retaining their steam systems merely for operation at low pressure for heating purposes.

The effect of the use of electricity in reducing the amount of other kinds of rented power has already been pointed out. The various central station companies throughout the country have found in the development of this class of business a large and profitable source of income, giving them a load for their generating apparatus in the daytime and thus keeping their plant busy to very nearly its full capacity at all hours of the day and night. In the special report of the Bureau of the Census on Central Electric Light and Power Stations, in 1902, statistics were given showing that the 3,620 plants from which figures were collected, derived $14,048,458, or 16.4 per cent of their total income ($85,700,605) from electric service other than arc or incandescent lighting. This service was almost entirely of the rented electric power character in this report. Hence central station and power transmission companies during the past few years have devoted special attention to this class of business, encouraging it by low rates, liberal discounts, etc. The contract drawn up by the electric companies with their industrial customers often includes clauses to the effect that for a period of years from date the lessor agrees to furnish and the lessee to receive and pay for within the time and on the terms set forth, all the electrical energy that may be required to drive and to light his plant properly. The amount of the bill is determined by meter readings at such rates as the following: 1,800 to 2,160 kilowatt hours, at $13.50 per kilowatt hour per annum; more than 2,160 kilowatt hours and not exceeding 2,520, at the rate of $30 per kilowatt hour per annum; more than 2,520 kilowatt hours and not exceeding 2,700, at the rate of $28.50 per kilowatt hour per annum; all in excess of 2,700 kilowatt hours, at the rate of $27.50. The above rates are based on an "annum" of 3,000 hours.

It is stated that central station managers do not have much difficulty in obtaining industrial power customers up to a capacity of 10 or 15 horsepower, as the cost of running motors of this size is generally below the cost of running a small steam engine or other prime mover, when all the items that go to make up the operating cost are taken into consideration.

An interesting feature in the development of such work has been the study of the average load of electrical energy consumed as related to the capacity of motor plant installed, and reports on the subject of purchased electric power in factories in this respect have been presented to the National Electric Light Association. For example, in boiler shops throughout the country with individual motor drive and with a connected motor capacity of 161 horsepower the percentage of average load was 20.7. In foundries with a connected load of 445.5 horsepower the percentage of average load to connected load was 43.7. In a large number of general manufacturing establishments usually with group-driving of machinery, in some plants employing as many as 40 and 50 motors, the total connected motor load was 12,231.5 horsepower. The percentage of average load to connected motor load was 33.9. In ice machinery and refrigeration the percentage ran up to 53.4. Aside from the question involved as to the relative economy between individual and group-motor drive, it will be seen that the plant at the central station during the daytime could have connected to its circuits a capacity of motors far beyond its actual ability to supply, for the reason that the actual demand at any moment is so far below the consumption of which the motors are capable. On the other hand, it is to the advantage of central station companies to secure as a customer a busy machine shop rather than a dull factory, and to have at all times as large a demand as possible for its output of electrical energy.

EARNINGS OF WAGE-EARNERS

EARNINGS OF WAGE-EARNERS.

SUMMARY OF RESULTS.

Scope of the inquiry.—The difficulty attending all comprehensive analyses of wages, such as are given in Census reports, is to present statistics which will show, for a representative portion of the wage-earners, the rates of pay or the actual earnings.

The census of manufactures gives, for each establishment, a statement of the total amount paid in wages during the year, and also an estimate of the average number of wage-earners during the year; and it has been the practice to compute the average annual wages from these data. But so great are the uncertainties attending the computation of the average number of wage-earners that an average wage per wage-earner computed on this basis is misleading.[1] Hence it is deemed advisable to embody in the reports on manufactures some statistics of actual weekly earnings, in the hope that they will be utilized as a source of information on this subject, thus tending to check the use of the general average.

Moreover, not only do these statistics furnish a reliable basis for averages but they are valuable in themselves. While the true average brings together all of the various factors in the multitude of industries and occupations in the different sections of the country, and gives due weight to the relative numbers receiving different amounts, it does not convey any idea of the actual number receiving each amount—information which is essential to a proper understanding of the statistics. For scientific purposes the value of a presentation would be enhanced by an increase in the number of groups, and also by giving separate tables for the different industries and occupations.[2]

A complete and satisfactory report on this subject for the census of 1905 should give, for each of the 7,017,138 wage-earners reported as the greatest number employed at any one time during the census year,[3] the occupation, time employed, actual earnings, rates of pay or possible earnings, and conditions of employment; and the data should be summarized so as to show the true average, maximum, minimum, and predominating rates. But manifestly the time that can be devoted to the census of manufactures, and the appropriation available for the work, will not permit of the preparation of so elaborate a report.

[1] Census of Manufactures, 1905, Part I, page lxxxix; Twelfth Census, Employees and Wages, page xiii.
[2] Twelfth Census, Employees and Wages, pages xxiv and xxv.
[3] Census of Manufactures, 1905, Part I, page lxxix.

The difficulties attending the collection and compilation of data giving the actual daily or weekly rates of pay or earnings in the different occupations for even half of the wage-earners were so great that it was decided to abandon the system inaugurated at the census of 1900, which shows the actual hourly and weekly rates for different occupations,[4] and to confine the presentation to a classification of wage-earners according to their weekly earnings for the busiest week or a representative week of the census year, without regard to occupation. While this method does not permit of the exactness of statement that is possible when the actual earnings of each wage-earner are ascertained, the grouping, when based on the pay roll, is a true presentation of the numbers receiving the different amounts, and thus shows one of the most important facts connected with wage statistics. Further, the assignment of a number of wage-earners to each group makes possible the preparation of convenient summaries that cover the entire field of employment with a considerable degree of accuracy.

Statistics of wage-earners and wages are an important feature of the work of the state bureaus of labor statistics and other state offices, and the desire of these offices for information of the character contained in this report was another reason for the adoption of the classified earnings method of presentation.

Form of the inquiry.—The following instructions were given for the preparation of the answers to the inquiries from which these statistics were compiled:

INQUIRY 11.—CLASSIFIED EARNINGS OF WAGE-EARNERS, INCLUDING PIECEWORKERS, FOR THE WEEK DURING WHICH THE LARGEST NUMBER OF PERSONS WAS EMPLOYED.

117. This information is required for the three classes of employees—men 16 years and over, women 16 years and over, and children under 16 years of age—and is merely a transcript of the pay roll for the week in which the largest number was employed during the year, arranged so as to show the number of men, women, and children, respectively, at the specified earnings for the week. The distribution of the employees must be made according to actual earnings, not rates of pay. For instance, if an employee is rated at $6 per week and works only three days during the week selected, he should be included in the group of "$3 and over, but under $4." By consulting the pay roll for the week selected the number receiving each amount can be tallied in the schedule so as to obtain the desired result. In some instances it may be necessary to supplement the information on the pay roll by inquiry concerning the number of women and children, respectively, employed, but any person familiar with the personnel of the employees

[4] Twelfth Census, Employees and Wages.

can supply the number for each group. The answer to the inquiry must be for the period of one week. If the pay roll is for any other period, it must be reduced to a weekly basis before the figures are entered. If the establishment has no pay roll, secure and enter an estimate of the number at each weekly group. Give also the total amount paid as wages to men, women, and children separately for the week selected. The total wages for the week should not be less than the minimum or greater than the maximum as computed from the weekly earnings. It is essential that the segregation of the employees be made from a pay roll. In order that the Office may be fully advised as to the source of the information the agent must, in every instance, write on the margin of the schedule, opposite this inquiry, "Obtained from a pay roll," or, if the answer is estimated, the word "Estimated."

This inquiry formed a part of the regular Census schedule, and was submitted to every establishment that was in operation during any portion of the calendar year 1904. The reports were prepared from an actual record of payments, or from information furnished by the proprietor or by some one in authority who was familiar with the actual earnings. Verbal statements were accepted only when there were less than 10 wage-earners reported by the establishment; it is believed that where there are so few wage-earners the personal knowledge of the proprietor concerning the actual amount paid to each wage-earner for a selected week is reliable.

Naturally the reports for the different establishments were not all for the same week, because the busiest season varies according to the industry and the location; and the statistics are a compilation of the reports for the different weeks selected for the individual establishments. For some establishments it was difficult to obtain a report for the week during which the largest number of wage-earners was employed, and the report was prepared for a representative week.

Representative character of data.—There were 216,262 establishments reported at the census of manufactures of 1905, and of this number, 19,679 reported that no wage-earners were employed; therefore there were 196,583 establishments to be considered in connection with the preparation of the report on weekly earnings. But for 72,880 establishments the returns were so defective or unsatisfactory that they could not be used; deducting these, there remain 123,703 establishments, or 62.9 per cent of the whole number reporting wage-earners, for which statistics of classified earnings are presented.

The degree to which the statistics of weekly earnings reflect existing conditions for manufacturing industries as a whole, can best be measured by a comparison of the number of wage-earners reported for the week covered by these statistics (3,297,819) with the greatest number of wage-earners reported by the census of manufactures as employed in all establishments at any one time during the year (7,017,138). On this basis the statistics present the facts for 47 per cent, or nearly one-half, of all wage-earners.

But as the report on manufactures does not show separately the numbers of men, women, and children included in the "greatest number" referred to above, the degree to which the statistics of weekly earnings represent existing conditions for men, women, and children separately can be measured only by a comparison of the average number of wage-earners employed during the year by the establishments included in these statistics, or of the number of wage-earners reported for the selected week, with the average number of wage-earners employed during the year by all establishments.

TABLE 1.—*Average number of wage-earners employed during the year by establishments included in statistics of weekly earnings, and number of wage-earners reported for the week covered by these statistics, compared with the average number employed during the year by all establishments: 1905.*

CLASS OF WAGE-EARNERS.	Wage-earners in all establishments, average number.	WAGE-EARNERS IN ESTABLISHMENTS INCLUDED IN STATISTICS OF WEEKLY EARNINGS.			
		Average.		For specified week.	
		Number.	Per cent of average number, all establishments.	Number.	Per cent of average number, all establishments.
Total	5,470,321	2,686,756	49.1	3,297,819	60.3
Men 16 years and over	4,244,538	2,124,069	50.0	2,619,053	61.7
Women 16 years and over	1,065,884	488,832	45.9	588,599	55.2
Children under 16 years	159,899	73,855	46.2	90,167	56.4

For the total average number of wage-earners Table 1 assigns to the statistics of weekly earnings even greater significance than does the text comparison presented for the greatest number employed at any one time. It also indicates that the statistics for men are representative to a greater degree than are those for women and children.

When measured by the average number of wage-earners employed during the year in all establishments, the proportion of the whole number of wage-earners reported for the week covered by the statistics of weekly earnings is unduly magnified; when measured by the greatest number employed at any one time during the year, this proportion shows a tendency in the opposite direction. The actual proportion of all wage-earners represented by the statistics of weekly earnings is somewhere between these two extremes, or between 60.3 per cent and 47 per cent, and it may safely be assumed that it is about one-half.

This proportion does not, however, prevail uniformly in all states or in all industries. The percentage that the number reported for the week by the establishments included in the statistics of weekly earnings forms of the greatest number employed in all establishments at any one time during the year, falls as low

as 19.3 per cent in Louisiana and rises to 86.6 per cent in Wyoming. The percentage that the same number forms of the average number employed in all establishments during the year, is lowest (30.5 per cent) in Louisiana and highest (118.6 per cent) in Wyoming. Among the 25 selected industries shown in Table 72 there is also a marked variation in the proportion. The number reported for the week by the establishments included in the statistics of weekly earnings forms only 27.1 per cent of the greatest number for all establishments in the manufacture of "clothing, women's," but rises as high as 58.8 per cent in "leather, tanned, curried, and finished." The comparison with the average number employed in all establishments during the year shows the lowest proportion (34.5 per cent) in "clothing, men's," and the highest (70.7 per cent) in "foundry and machine shop products."

General results.—Table 2 summarizes the results of the investigation for all branches of manufactures in the United States. The inquiry called for the segregation of wage-earners according to groups of actual earnings, and not rates of pay; therefore the distribution gives the actual numbers that earned the specified amounts during the week covered by the report. The terms "wages" and "earnings" are frequently used synonymously. Earnings, and not rates of wages, either actual or other, are given in this report. The totals include pieceworkers, and cover all branches of employment in the manufacturing industries of the country, exclusive of the office force.

Table 2.—UNITED STATES—SUMMARY OF ALL WAGE-EARNERS, AND MEN, WOMEN, AND CHILDREN, BY CLASSIFIED WEEKLY EARNINGS, WITH PERCENTAGE AT EACH AMOUNT: 1905.

WEEKLY EARNINGS.	ALL WAGE-EARNERS.			MEN 16 YEARS AND OVER.			WOMEN 16 YEARS AND OVER.			CHILDREN UNDER 16 YEARS.		
	Number.	Percentage in the group.	Cumulative percentage.	Number.	Percentage in the group.	Cumulative percentage.	Number.	Percentage in the group.	Cumulative percentage.	Number.	Percentage in the group.	Cumulative percentage.
Total	3,297,819	100.0	....	2,619,053	100.0	....	588,599	100.0	....	90,167	100.0	....
Less than $3	132,064	4.0	100.0	56,346	2.2	100.0	43,858	7.5	100.0	31,860	35.3	100.0
$3 to $4	150,403	4.6	96.0	57,597	2.2	97.8	64,170	10.9	92.5	28,636	31.8	64.7
$4 to $5	194,301	5.9	91.4	87,739	3.4	95.6	88,657	15.1	81.6	17,905	19.9	32.9
$5 to $6	206,163	6.2	85.5	103,429	4.0	92.2	95,674	16.3	66.5	7,060	7.8	13.0
$6 to $7	262,531	8.0	79.3	161,940	6.2	88.2	97,311	16.5	50.2	3,280	3.6	5.2
$7 to $8	266,012	8.1	71.3	196,981	7.5	82.0	68,192	11.6	33.7	839	0.9	1.6
$8 to $9	255,458	7.7	63.2	207,954	7.9	74.5	47,170	8.0	22.1	334	0.4	0.7
$9 to $10	378,009	11.5	55.5	343,812	13.1	66.6	34,050	5.8	14.1	147	0.2	0.3
$10 to $12	439,208	13.3	44.0	409,483	15.6	53.5	29,633	5.0	8.3	92	0.1	0.1
$12 to $15	464,875	14.1	30.7	450,568	17.2	37.9	14,294	2.4	3.3	13	(1)	(1)
$15 to $20	390,367	11.8	16.6	385,647	14.7	20.7	4,719	0.8	0.9	1	(1)	(1)
$20 to $25	106,700	3.2	4.8	106,046	4.0	6.0	654	0.1	0.1	....	....	....
$25 and over	51,728	1.6	1.6	51,511	2.0	2.0	217	(1)	(1)	....	....	....
Earnings for the specified week:												
Total	$33,185,791			$29,240,287			$3,633,481			$312,023		
Average per wage-earner	$10.06			$11.16			$6.17			$3.46		

[1] Less than one-tenth of 1 per cent.

Of the 3,297,819 wage-earners covered by the investigation, 2,619,053, or 79.4 per cent, were men; 588,599, or 17.9 per cent, were women; and 90,167, or 2.7 per cent, were children.

The pay rolls of the 123,703 establishments for the week covered amounted to $33,185,791, and of this, men received $29,240,287, or 88.1 per cent; women, $3,633,481, or 11 per cent; and children, $312,023, or nine-tenths of 1 per cent.

As each establishment was requested to report the actual number employed during the week and the actual amount paid that number, it should be safe to use the above totals to compute the average earnings for the week. They give $10.06 as the average weekly earnings for all classes of wage-earners during the selected week, and $11.16, $6.17, and $3.46 as the averages for men, women, and children, respectively.

The classification shows the concentration of men at the higher and of women and children at the lower weekly earnings. More than one-half (55.5 per cent) of all the wage-earners received $9 and over per week. Two-thirds (66.6 per cent) of the men received $9 and over for the week, while only one-seventh (14.1 per cent) of the women were paid at this rate. The children receiving $9 and over were so few that they are included in the general tabulations with those receiving $8 and over, although in this table they are shown separately.

Among the 13 groups of earnings, the greatest number of men is reported for the group of $12 to $15 per week, and of women for the group of $6 to $7 per week. The greatest number of children is reported for the group receiving less than $3 per week.

In Table 2 the number and proportion of women and children are given for all of the groups of weekly earnings for which men were reported. This detail as to the higher groupings is not preserved in the other tables of the report, because there are comparatively few women and children reported for the higher rates, and to give the number at each rate in all of the detailed tables would lead to an extended presentation, in which there would be numerous blank spaces and but few figures. It is important, however, to know the states in which women and children were reported for the higher earnings, and such information is given in Table 3.

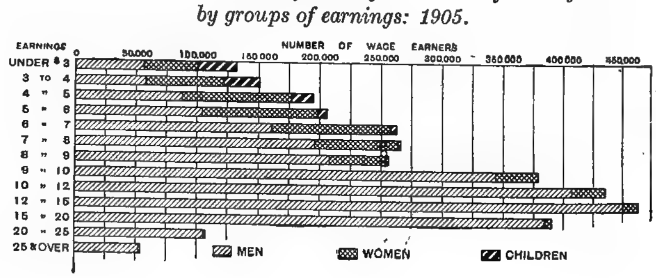
TABLE 3.—WOMEN AND CHILDREN IN GROUPS OF HIGHEST WEEKLY EARNINGS, BY STATES: 1905.

STATE OR TERRITORY.	WOMEN 16 YEARS AND OVER.				CHILDREN UNDER 16 YEARS.					
	Total receiving $15 and over.	$15 to $20.	$20 to $25.	$25 and over.	Total receiving $8 and over.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 to $20.
United States	5,590	4,719	654	217	587	334	147	92	13	1
Alabama	1		1		1		1			
Alaska	2			2						
Arizona	1		1		1		1			
Arkansas	2	1	1							
California	417	343	52	22	89	41	34	11	3	
Colorado	19	19			41	14	4	22	1	
Connecticut	76	62	13	1	19	12	3	4		
District of Columbia	2		1	1						
Florida	78	75	3		1	1				
Georgia	6	5		1	1		1			
Idaho	3	3			4		4			
Illinois	394	315	57	22	7	4	2		1	
Indiana	39	31	7	1	44	21	12	11		
Iowa	15	14	1		8	2	2	4		
Kansas	11	10	1		9	5	2	1	1	
Kentucky	11	11			2	2				
Louisiana	1	1			16	16				
Maine	155	130	23	2	37	19	14	4		
Maryland	32	21	8	3	4	2	2			
Massachusetts	1,471	1,317	137	17	120	87	24	9		
Michigan	47	41	3	3	7	6	1			
Minnesota	59	46	11	2						
Mississippi					1	1				
Missouri	78	65	8	5	9	6	3			
Montana	9	3	2	4	23	4	2	13	4	
Nebraska	11	11			8	4	3		1	
Nevada	1		1							
New Hampshire	44	44								
New Jersey	209	194	13	2	19	13	6			
New Mexico					1		1			
New York	1,895	1,518	271	106	17	15	2			
North Carolina					1	1				
Ohio	123	103	13	7	9	6	1	2		
Oklahoma	2	2			1	1				
Oregon	5	4	1		5		3	2		
Pennsylvania	183	151	20	12	58	39	9	7	2	1
Rhode Island	135	131	3	1	1		1			
South Carolina	2	2			1	1				
South Dakota	5	5			1	1				
Tennessee	2	2								
Texas	7	7			1	1				
Utah	3	1		2	1		1			
Vermont	3	3			5	2	2	1		
Virginia	3	3								
Washington	17	15	1	1	6	1	5			
West Virginia	6	6			2	2				
Wisconsin	4	3	1		6	4	1	1		
Wyoming	1	1								

In all other tables but Table 2 where women and children are shown for 1905, the 5,590 women given above are reported as of the group of $15 and over, and the 587 children as of the group of $8 and over.

The following diagram shows the importance of the men, women, and children reported at the different weekly earnings. This diagram is based on the entire number of wage-earners reported for the week covered by the inquiry.

DIAGRAM 1.—*Classified weekly earnings—number of all wage-earners, by groups of earnings: 1905.*



The 196,583 establishments that reported the employment of wage-earners at the census of 1905 returned $2,611,540,532 as the amount paid in wages during the year, but the annual amount paid by the 123,703 establishments included in the statistics of weekly earnings treated in this report was not tabulated separately. The amount of wages paid annually by these establishments can not be estimated by multiplying the amount reported for the selected week by 52 because: (1) In most instances the week is that during which the largest number of wage-earners was employed, and is not necessarily a representative week; (2) a number of establishments were in operation during only a part of the year; (3) the time lost by wage-earners by reason of sickness and other causes is not the same for all seasons, and hence the wages paid during the week when the largest number was employed may be in excess of, or less than, the pay roll of weeks in which a smaller number was employed. The number of men, women, and children reported for the week and the total amount of their weekly earnings should be considered in connection with their average earnings, and therefore these figures are given in the tables presenting the statistics by industries and states.

Table 67 gives the number and Table 68 the average weekly earnings, with the per cent distribution of men, women, and children at each amount of classified weekly earnings in each industry for the United States; Table 71 includes the average weekly earnings and per cent distribution by earnings for 25 prominent industries, by states and territories. Tables 69 and 70 present the total number and per cent distribution by earnings of men, women, and children in each state and territory, while Table 72 includes like details, and average weekly earnings, for selected industries in 25 leading states.

A study of these tables assists in an understanding of the subject of weekly earnings in all branches of manufactures and in leading industries in different sections of the country.

While the statistics of classified earnings for the 3,297,819 wage-earners shown in Table 2 are representative of the earnings of all employed in manufactures, and are sufficient to convey a correct idea of the proportions at each classified amount, it is desirable for some purposes to make a distribution of this character of the entire number employed in all establishments; this is done in Table 4.

TABLE 4.—ESTIMATED DISTRIBUTION BY WEEKLY EARNINGS OF AVERAGE NUMBER OF ALL WAGE-EARNERS, AND MEN, WOMEN, AND CHILDREN: 1905.

WEEKLY EARNINGS.	ALL WAGE-EARNERS.			MEN 16 YEARS AND OVER.			WOMEN 16 YEARS AND OVER.			CHILDREN UNDER 16 YEARS.		
	Number.	Percentage in the group.	Cumulative percentage.	Number.	Percentage in the group.	Cumulative percentage.	Number.	Percentage in the group.	Cumulative percentage.	Number.	Percentage in the group.	Cumulative percentage.
Total	5,470,321	100.0	....	4,244,538	100.0	....	1,065,884	100 0	....	159,899	100.0	....
Less than $3	225,793	4.1	100.0	92,535	2.2	100.0	77,826	7.3	100.0	55,432	34.7	100.0
$3 to $4	264,626	4.8	95.9	96,569	2.3	97.8	115,741	10.9	92.7	52,316	32.7	65.3
$4 to $5	340,113	6.2	91.1	149,531	3.5	95.5	158,926	14.9	81.8	31,656	19.8	32.6
$5 to $6	363,693	6.7	84.9	177,550	4.2	92.0	173,713	16.3	66.9	12,430	7.8	12.8
$6 to $7	454,285	8.3	78.2	272,288	6.4	87.8	176,224	16.5	50.6	5,773	3.6	5.0
$7 to $8	453,203	8.3	69.9	327,726	7.7	81.4	124,061	11.7	34.1	1,416	0.9	1.4
$8 to $9	423,689	7.8	61.6	336,669	7.9	73.7	86,467	8.1	22.4	553	0.3	0.5
$9 to $10	619,465	11.3	53.8	557,046	13.1	65.8	62,193	5.8	14.3	226	0.1	0.2
$10 to $12	708,858	13.0	42.5	654,435	15.4	52.7	54,340	5.1	8.5	83	0.1	0.1
$12 to $15	741,036	13.5	29.5	714,816	16.9	37.3	26,207	2.5	3.4	13	(1)	(1)
$15 to $20	618,314	11.3	16.0	609,797	14.4	20.4	8,516	0.8	0.9	1	(1)	(1)
$20 to $25	171,844	3.1	4.7	170,571	4.0	6.0	1,273	0.1	0.1	....	....	....
$25 and over	85,402	1.6	1.6	85,005	2.0	2.0	397	(1)	(1)	....	....	....

[1] Less than one-tenth of 1 per cent.

Table 4 was constructed by applying the percentage of men, women, and children, respectively, reported in each group of earnings for each industry in Table 69 to the average number for all establishments in each industry as given in the general report for manufactures, census of 1905. The average number employed during the year is used as the basis of the calculation, because the greatest number employed at any one time is not shown for men, women, and children separately, and also because the average number is the number required to conduct the business of the year; its distribution by weekly earnings shows normal conditions for the entire period. The greatest number was employed during a comparatively short period, and its distribution by weekly earnings would give an excessive number at the different rates. In order to give proper weight to the numbers reported at the different earnings, the calculation was made for each industry and the totals combined to give the aggregate for the United States. The differences between the percentages in the two tables are not large, and the results are accurate enough for the purpose. To be exact the computation should have been made separately for each industry in each state and territory; the results should then have been combined to produce the total for each industry in the United States, and finally for all industries. It is probable the result of such a process would differ but slightly, if at all, from the figures given in Table 4, and therefore the shorter method was used. The table derives its value from the fact that it covers

the entire number of wage-earners required in the operation of all the factories in the country, and it is perhaps the most concrete method of showing the wages or possible earnings of such a large body of employees.

In some instances there would be considerable difference between the actual wages and the possible earnings during the same period calculated at a given rate per hour or day. The use of either earnings or rates as the basis for the construction of a table of this character necessarily gives results which differ in some particulars from actual conditions. If it were possible to obtain the classified earnings of all employees in all establishments during each week of the census year, it is probable there would be no week for which the number at each group would agree with the figures here presented. Nevertheless it is believed that the table shows a close estimate of the numbers at the different earnings during a representative week. Other than the average annual earnings obtained by dividing the average number into the total wages paid during the year, this is the only presentation ever made in a Federal Census report which gives a comprehensive idea of earnings for all wage-earners employed in manufactures.

Some of the causes which affect earnings are pointed out in this report, in the attempt to account for differences between earnings in the same industries in different states or sections. But a complete discussion of wages involves a deeper analysis; of which, however, the present report does not take cognizance. Among the influences to be considered in such an analysis are: Supply of labor, including women or children able to displace men as operatives; trades unions; organizations of employers; industrial combinations; standard and cost of living; industrial diversity; character of manufactures; degree of skill of the operative; conditions of business, whether prosperous or otherwise; number of hours and days worked; laws regulating the employment of women and children; differences in methods and processes, and in the extent to which machinery can be used; character of machinery, whether demanding in its operation more or less of skilled labor than is required in hand processes; and urban or rural location of factories. An intimate acquaintance with the conditions surrounding each industry is required for the complete understanding and accurate discussion of the more important phases of the subject.

INDUSTRIES.

A combination of the statistics of weekly earnings in various industries tends to an equalization of the proportions at the different amounts; that is, the relatively large number at the higher earnings in some industries is counterbalanced by the number reported at the lower earnings in other industries. For example, the combination of the statistics for a glass factory in which some of the blowers received $1.17 per hour with those for a cotton mill in which the highest pay for spinners was 9 cents per hour, tends to equalize in the total the proportions of wage-earners at the various amounts of earnings.

A knowledge of the earnings in the different industries and occupations is important; but as no statistics of occupations were collected, the detailed presentation of earnings is confined to states and industries.

While the degree of concentration at each amount of earnings is measured accurately by the percentage distribution, the median and the average furnish more convenient means of comparing the different industries. Table 5 shows, for men, women, and children, the 7 industries with the highest averages and the 7 with the lowest.

The 34 different industries given in Table 5 showing exceptionally high or low averages can not be considered as representative of the earnings prevailing in any group of manufactures or in any section of the country. While machinery is used to some extent in each, but few are considered as forming a part of the factory system. In most of them the rates of pay are controlled by conditions which are peculiar to the industry and which have very little effect on the rates in other industries—even those conducted in the immediate neighborhood.

Of the industries shown as having the highest earnings, the manufacture of watches and of gold pens are given for both men and women, and wool scouring and the manufacture of beet sugar for both women and children. Of the industries shown as having the lowest weekly earnings, the manufacture of oil, cottonseed and cake, is given for men, women, and children, and the turpentine and rosin industry and the grading, roasting, cleaning, and shelling of peanuts are included in the groups for men and women. There are no other duplications among the industries included in Table 5.

Some of these industries gave employment to large numbers of wage-earners, as returned at the census of 1905, but for the majority of them the numbers included in the statistics of classified earnings are so small as to detract from the significance of the figures. Wage-earners in excess of 10,000 are reported only for gas, illuminating and heating; oil, cottonseed and cake; and tobacco, chewing and smoking, and snuff.

TABLE 5.—INDUSTRIES REPORTING THE HIGHEST AND THE LOWEST AVERAGE WEEKLY EARNINGS FOR MEN, WOMEN, AND CHILDREN: 1905.

AT HIGHEST EARNINGS.				AT LOWEST EARNINGS.			
INDUSTRY.	Number of wage-earners.	Median group.	Average weekly earnings.	INDUSTRY.	Number of wage-earners.	Median group.	Average weekly earnings.
MEN 16 YEARS AND OVER.							
Lapidary work	187	$20 to $25	$21.68	Turpentine and rosin	7,697	$5 to $6	$5.23
Corsets	523	12 to 15	16.99	Flax and hemp, dressed	110	5 to 6	5.81
Photolithographing and photoengraving	2,085	15 to 20	16.68	Canning and preserving, oysters	213	5 to 6	6.27
Wood carpet	325	15 to 20	16.61	Oil, cottonseed and cake	12,144	6 to 7	6.64
Statuary and art goods	964	15 to 20	16.45	Tobacco, chewing and smoking, and snuff	8,703	6 to 7	6.86
Watches	2,740	15 to 20	16.16	Peanuts, grading, roasting, cleaning, and shelling	67	6 to 7	7.12
Pens, gold	73	15 to 20	16.05	Rice, cleaning and polishing	241	6 to 7	7.21
WOMEN 16 YEARS AND OVER.							
Scales and balances	14	$12 to $15	$11.07	Roofing materials	5	Less than $3	$2.00
Beet sugar	4	[1] 12 to 15 7 to 8	10.75	Peanuts, grading, roasting, cleaning, and shelling	392	Less than $3	2.26
Pens, gold	2	[1] 12 to 15 9 to 10	10.50	Oil, cottonseed and cake	12	Less than $3	2.50
Smelting and refining, lead	10	9 to 10	10.30	Hones and whetstones	3	Less than $3	2.67
Watches	2,474	8 to 9	8.93	Oakum	18	[1] $3 to $4 Less than $3	2.78
Oil, not elsewhere specified	24	7 to 8	8.67	Engraving, wood	1	$3 to $4	3.00
Wool scouring	30	9 to 10	8.63	Turpentine and rosin	1	3 to 4	3.00
CHILDREN UNDER 16 YEARS.							
Beet sugar	46	$8 and over	$9.22	Pickles, preserves, and sauces	105	Less than $3	$1.84
Smelting and refining, copper	44	$7 to $8	7.09	Oil, cottonseed and cake	1	Less than $3	2.00
Wool pulling	1	7 to 8	7.00	Wheelbarrows	1	Less than $3	2.00
Tin and terne plate	2	6 to 7	6.00	Rules, ivory and wood	4	Less than $3	2.25
Wool scouring	6	6 to 7	6.00	Shoddy	4	[1] $3 to $4 Less than $3	2.25
Galvanizing	11	5 to 6	5.91	Wood preserving	8	[1] $3 to $4 Less than $3	2.25
Chocolate and cocoa products	10	5 to 6	5.90	Gas, illuminating and heating	7	Less than $3	2.29

[1] Each group includes 50 per cent.

As a rule the numbers of wage-earners reported at the exceptionally high or low earnings were much larger in the case of men than for either women or children. In only 2 industries—the manufacture of gold pens and the grading, roasting, cleaning, and shelling of peanuts—does the number of men fall below 100. On the other hand, the number of women is in excess of 100 only for the manufacture of watches and the grading, roasting, cleaning, and shelling of peanuts, and the number of children exceeds 100 only for the manufacture of pickles, preserves, and sauces. Hence the exceptional earnings shown for women and children should not be considered as typical cases.

The averages in Table 5 are interesting as representing the extremes of the earnings of men, women, and children covered by the report. The highest average for men was more than four times, and for women and children more than five times, the lowest average for each of these classes. The general average for men employed in all industries in the United States, $11.16, was $5.93 above the minimum and $10.52 below the maximum; the general average for women, $6.17, was $4.17 above the minimum and $4.90 below the maximum; and the general average for children, $3.46, was $1.62 above the minimum and $5.76 below the maximum.

The highest weekly earnings for men are reported for the lapidary industry—the average for men exceeding by nearly $5 the average second in rank. The principal occupations in this industry—those which control the rates—are connected with the cutting, polishing, and setting of diamonds and other precious stones. Even when assisted by the use of power-driven machinery, occupations of this character require exceptional skill, and the responsibility incident to the possible errors in judgment when manipulating the material tends to increase the compensation. Similar conditions are found in most of the controlling occupations for each of the other industries showing the highest earnings for men. For example, the average earnings of the men employed in the manufacture of corsets were controlled by 8 establishments reported for Massachusetts, where men were apparently employed in a few occupations that commanded the highest pay. The average for all wage-earners employed in this industry was far less than that for men, because over seven-eighths of the whole number were women. The average for men employed in the manufacture of wood carpets was controlled by establishments in New York city; they were engaged principally in manufacturing and laying parquet flooring, for which more than ordinary skill is required.

The 7 industries showing the lowest earnings for men are concentrated largely in the Southern states, where the lowest earnings prevail; in the majority of them the occupations are simple, and under the most

favorable conditions could not command high wages. Most of the men reported for the turpentine and rosin industry, for example, were engaged in the gathering of the crude gum, which is in some respects the lowest order of employment reported in connection with the census of manufactures. In the cottonseed-oil industry large numbers were engaged in handling the raw material and the finished product, comparatively few being employed in connection with the operation of the machinery or in the actual production.

Of the industries reporting the highest earnings for women, the manufacture of watches is the only one for which considerable numbers are included in the statistics of classified earnings. In the watch industry, and in the manufacture of scales and balances and of gold pens, women are employed in occupations in which a high grade of skill and deftness is required. In the other industries for which high earnings are shown for women, the rates should be considered as exceptions rather than as indicating prevailing conditions.

The grading, roasting, cleaning, and shelling of peanuts is the only one of the 7 industries reporting the lowest earnings for women in which a representative number was employed—392 out of the 459 wage-earners included in the statistics of weekly earnings being women. This industry also shows by far the lowest average for all wage-earners—$2.97; for no other industry is the corresponding average less than $5. The occupations are simple, and as a rule the industry is conducted under conditions that make the lowest wages possible.

Of the 14 industries representing the extremes in the earnings of children, the manufacture of pickles, preserves, and sauces is the only one in which more than 100 children were employed. The beet sugar factories and smelting plants, in which the highest earnings were reported for children, are located in Colorado and other Western states, where high earnings prevail.

Of the 331 industries shown separately for the United States in Table 68, 147 reported averages for men which were in excess of the general average for all industries—$11.16. For 248 industries, or about three-fourths of the total number, the averages for men fell between $9 and $13; the one-dollar group including the largest number of industries was $10 to $11—91 industries having averages within those limits.

Of the 298 industries for which women were reported, 102 showed averages for women which were greater than the general average for all industries—$6.17. For 240 industries, or more than four-fifths of the total number, the averages for women were between $4 and $7; the one-dollar group including the largest number was $5 to $6—113 industries having averages within those limits.

Of the 289 industries reporting children, 190 showed averages for children which exceeded the general average for all industries—$3.46. For 223 industries, or practically four-fifths of the total number, the averages for children were between $3 and $5; the one-dollar group including the largest number was $3 to $4—156 industries having averages within those limits.

Although the numbers of wage-earners receiving extremely high or low earnings indicate the range of possibility in manufacturing industries, the numbers at the intervening rates are of greater significance. Table 71 gives, for each of 25 selected industries, by states, the average earnings of men, women, and children, and the percentage distribution of their total numbers by groups of classified earnings. In but few instances do the averages for any of these industries fall outside the limits within which, as shown above, the earnings for at least three-fourths of all industries are included.

The controlling influence of these 25 industries upon the statistics of weekly earnings is indicated by Table 6.

TABLE 6.—TWENTY-FIVE SELECTED INDUSTRIES—PER CENT WHICH NUMBER AND EARNINGS OF MEN, WOMEN, AND CHILDREN FORM OF NUMBER AND EARNINGS IN ALL INDUSTRIES INCLUDED IN CLASSIFIED WEEKLY EARNINGS: 1905.

CLASS OF WAGE-EARNERS.	NUMBER.			EARNINGS.		
	Total.	In 25 selected industries.		Total.	In 25 selected industries.	
		Number.	Per cent of total.		Amount.	Per cent of total.
All wage-earners	3,297,819	1,688,754	51.2	$33,185,791	$16,472,922	49.6
Men 16 years and over	2,619,053	1,282,692	49.0	29,240,287	14,089,318	48.2
Women 16 years and over	588,599	345,641	58.7	3,633,481	2,178,465	60.0
Children under 16 years	90,167	60,421	67.0	312,023	205,139	65.7

While information concerning the actual numbers of men, women, and children reported at the different amounts of classified earnings for each industry in each state would be of interest, the tables presenting the statistics are too extensive to be included in this report. It is believed that the percentage distributions included in Table 72 are sufficient to illustrate the use of the data.

Table 7 affords a comparison of the earnings of men, women, and children in the 25 selected industries, and also furnishes a measure of the degree to which these statistics may be considered as representative of the entire industry.

TABLE 7.—MEDIAN GROUPS AND AVERAGE WEEKLY EARNINGS, ALL WAGE-EARNERS AND MEN, WOMEN, AND CHILDREN IN TWENTY-FIVE SELECTED INDUSTRIES: 1905.

[At least one-half of all the wage-earners, or of men, women, or children, received earnings as great as, or greater than, the lowest earnings of the median group.]

INDUSTRY.	WAGE-EARNERS.			MEDIAN GROUPS AND AVERAGE WEEKLY EARNINGS.							
	Greatest number employed at any one time during the year in all establishments.	Number in specified week, selected establishments.		All wage-earners.		Men 16 years and over.		Women 16 years and over.		Children under 16 years.	
		Number.	Per cent of greatest number in all establishments.	Median group of earnings.	Average weekly earnings.	Median group of earnings.	Average weekly earnings.	Median group of earnings.	Average weekly earnings.	Median group of earnings.	Average weekly earnings.
All industries	7,017,138	3,297,819	47.0	$9 to $10	$10.06	$10 to $12	$11.16	$6 to $7	$6.17	$3 to $4	$3.46
Twenty-five selected industries	3,757,740	1,688,754	44.9	9 to 10	9.75	10 to 12	10.98	6 to 7	6.30	3 to 4	3.40
Agricultural implements	62,979	31,016	49.2	10 to 12	10.90	10 to 12	10.97	5 to 6	5.75	3 to 4	3.12
Boots and shoes	174,650	92,002	52.7	9 to 10	10.24	10 to 12	11.88	7 to 8	7.60	3 to 4	3.56
Carriages and wagons	74,698	41,978	56.2	10 to 12	10.69	10 to 12	10.83	5 to 6	5.85	3 to 4	3.53
Clothing, men's	158,437	47,344	29.9	7 to 8	8.50	10 to 12	12.23	6 to 7	6.07	Less than $3	2.98
Clothing, women's	148,503	40,312	27.1	7 to 8	9.01	12 to 15	13.52	6 to 7	6.85	$3 to $4	3.49
Cotton goods	351,415	202,211	57.5	6 to 7	6.47	7 to 8	7.71	6 to 7	6.03	3 to 4	3.21
Electrical machinery, apparatus, and supplies	78,360	36,875	47.1	9 to 10	9.88	10 to 12	10.85	6 to 7	6.37	3 to 4	3.67
Foundry and machine shop products	426,148	246,177	57.8	10 to 12	11.79	10 to 12	11.88	5 to 6	5.83	3 to 4	4.01
Furniture	128,549	56,918	44.3	9 to 10	9.86	9 to 10	10.16	5 to 6	5.53	3 to 4	3.55
Glass	87,586	36,368	41.5	10 to 12	12.82	10 to 12	14.10	4 to 5	5.08	4 to 5	4.22
Hosiery and knit goods	116,869	45,347	38.8	6 to 7	6.48	8 to 9	8.90	6 to 7	6.01	3 to 4	3.19
Iron and steel, blast furnaces	47,361	23,839	50.3	10 to 12	11.70	10 to 12	11.71	5 to 6	5.00	5 to 6	5.33
Iron and steel, steel works and rolling mills	256,135	119,069	46.5	10 to 12	12.45	10 to 12	12.56	5 to 6	5.95	4 to 5	4.58
Leather, tanned, curried, and finished	68,464	40,259	58.8	9 to 10	9.67	9 to 10	9.90	5 to 6	5.68	4 to 5	4.08
Lumber and timber products	640,369	177,022	27.6	9 to 10	9.21	9 to 10	9.25	5 to 6	5.22	3 to 4	3.59
Lumber, planing mill products, including sash, doors, and blinds	121,421	50,787	41.8	10 to 12	11.05	10 to 12	11.15	5 to 6	5.18	3 to 4	3.65
Paper and wood pulp	75,634	38,294	50.6	9 to 10	9.81	9 to 10	10.64	6 to 7	5.85	4 to 5	4.86
Pottery, terra cotta, and fire clay products	63,666	24,242	38.1	9 to 10	10.32	9 to 10	10.87	5 to 6	5.69	4 to 5	4.02
Printing and publishing, book and job	106,675	52,916	49.6	10 to 12	11.21	12 to 15	12.94	6 to 7	6.54	3 to 4	3.54
Printing and publishing, newspapers and periodicals	111,480	64,551	57.9	10 to 12	11.39	12 to 15	13.13	5 to 6	5.95	3 to 4	2.87
Shirts	43,157	16,765	38.8	5 to 6	6.33	9 to 10	10.20	5 to 6	5.69	Less than $3	2.31
Silk and silk goods	90,717	30,486	33.6	6 to 7	7.28	10 to 12	10.57	5 to 6	6.11	$3 to $4	3.13
Tobacco, cigars and cigarettes	163,982	84,292	51.4	7 to 8	8.72	10 to 12	11.14	5 to 6	5.97	Less than $3	3.00
Woolen goods	82,241	43,881	53.4	7 to 8	8.23	9 to 10	9.29	6 to 7	6.91	$3 to $4	3.83
Worsted goods	78,244	45,803	58.5	7 to 8	7.91	9 to 10	9.83	6 to 7	6.78	3 to 4	3.82

Of the 3,757,740 wage-earners included, at the census of 1905, as the greatest number employed at any one time during the year in these 25 industries, the wage-earners included in the statistics of classified earnings form 44.9 per cent. Among the different industries this percentage varies from 27.1 in clothing, women's, to 58.8 in leather, tanned, curried, and finished. For 11 of the industries the proportion is over one-half, and for only 4 it is less than three-eighths. The degree to which the men, women, and children included in the totals represent the numbers of each reported by all establishments can be approximated only by a comparison with the average numbers employed during the entire year, and, as explained under the side caption "representative character of data," such a comparison gives undue weight to the statistics of weekly earnings.

Of the 25 selected industries, glass led in average earnings of men, and cotton goods was last; men predominated in the former, which is an industry using comparatively little machinery, and women and children in the latter, which is a manufacture wholly dependent upon machinery.

The average for women was highest in the highly organized factory industry of boots and shoes. It was lowest in iron and steel, blast furnaces; but among industries employing women to any considerable extent, the manufacture of glass was the lowest in rank.

Iron and steel, blast furnaces, is the industry for which the highest average earnings were reported for children; among the industries employing considerable numbers the highest average is shown for the manufacture of glass. The average earnings of children were lowest in the manufacture of shirts, an industry which gives employment to large numbers of children.

The highest median group for men, $12 to $15, was not exceeded by the corresponding averages for women's clothing, and the two printing and publishing classifications for which it is shown. In glass, however, the average of $14.10 greatly exceeded the median of $10 to $12, because of the large numbers reported at the highest earnings. The lowest median

group for men was $7 to $8, for cotton goods, which also shows the lowest average.

For women the highest median was $7 to $8, in boots and shoes, and the lowest was $4 to $5, in glass. Except in glass, paper and wood pulp, and silk and silk goods, the results obtained from the median and the average agree.

Children's earnings, as determined by the median, were highest, $5 to $6, in blast furnaces; and lowest, less than $3, for shirts, men's clothing, and tobacco, cigars and cigarettes. The manufacture of shirts appears to rank lowest according to the median—86.5 per cent of all children employed in the industry being included in the lowest earnings group—and the results obtained from the median and the average agree.

Proportional numbers and earnings.—In 11 of the 25 selected industries the men formed more than 85 per cent of the total number of wage-earners, and received more than 90 per cent of the total earnings. These 11 include both iron and steel industries, and the manufacture of foundry and machine shop products; both lumber industries, and the manufacture of furniture; the glass and pottery industries; and the manufacture of agricultural implements, carriages and wagons, and leather, tanned, curried, and finished. The highest proportions were shown for blast furnaces.

In 7 of the industries the men formed between 15 and 50 per cent of the total number of wage-earners and received between 25 and 60 per cent of the total earnings. These include all the textile industries except the manufacture of woolen goods, and all the clothing industries.

The industries in the intermediate group are the remaining textile industry—woolen goods; the manufacture of boots and shoes, which belongs in the same industrial group with the leather industry, already mentioned; the two printing and publishing industries; paper and wood pulp; electrical machinery, apparatus, and supplies; and tobacco, cigars and cigarettes.

In the industries showing the highest proportions for men, the women formed less than 8 per cent of the total number and received less than 5 per cent of the total earnings; in the intermediate group the women formed between 15 and about 40 per cent of the total number and received between 9 and 30 per cent of the total earnings; in the industries showing the lowest proportions for men, the women formed between 40 and 80 per cent of the total number and received between 35 and about 70 per cent of the total earnings. The highest proportions were shown for the manufacture of shirts.

TABLE 8.—*Proportional numbers and earnings, men, women, and children, in twenty-five selected industries: 1905.*

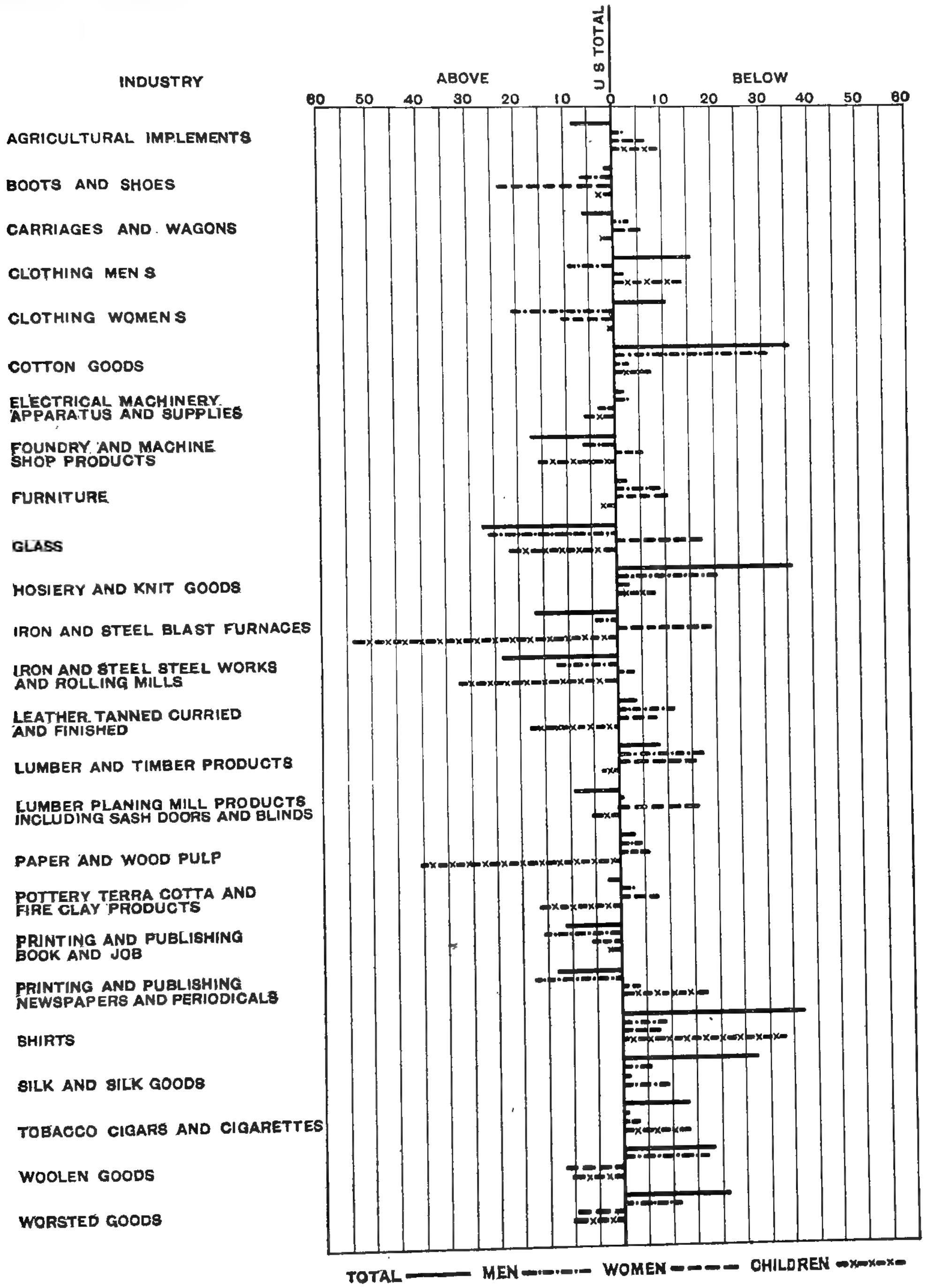
INDUSTRY.	PER CENT OF TOTAL.					
	Men 16 years and over.		Women 16 years and over.		Children under 16 years.	
	Number.	Earnings.	Number.	Earnings.	Number.	Earnings.
All industries	79.4	88.1	17.9	11.0	2.7	0.9
Twenty-five selected industries	75.9	85.5	20.5	13.2	3.6	1.3
Agricultural implements	98.9	99.6	0.5	0.2	0.6	0.2
Boots and shoes	64.3	74.6	32.8	24.4	2.9	1.0
Carriages and wagons	97.6	98.9	1.5	0.8	0.9	0.3
Clothing, men's	40.3	58.0	58.1	41.4	1.6	0.6
Clothing, women's	32.8	49.2	66.3	50.5	0.9	0.3
Cotton goods	47.0	56.0	40.5	37.8	12.5	6.2
Electrical machinery, apparatus, and supplies	79.3	87.1	19.3	12.4	1.4	0.5
Foundry and machine shop products	98.7	99.4	0.8	0.4	0.5	0.2
Furniture	94.4	97.3	3.3	1.9	2.3	0.8
Glass	86.7	95.3	4.7	1.9	8.6	2.8
Hosiery and knit goods	25.5	35.0	65.1	60.3	9.4	4.7
Iron and steel, blast furnaces	99.8	99.9	(1)	(1)	0.2	0.1
Iron and steel, steel works and rolling mills	98.6	99.4	0.8	0.4	0.6	0.2
Leather, tanned, curried, and finished	95.1	97.4	3.3	1.9	1.6	0.7
Lumber and timber products	99.2	99.7	0.2	0.1	0.6	0.2
Lumber, planing mill products, including sash, doors, and blinds	98.6	99.5	0.5	0.2	0.9	0.3
Paper and wood pulp	82.9	89.8	16.6	9.9	0.5	0.3
Pottery, terra cotta, and fireclay products	90.1	94.8	7.9	4.4	2.0	0.8
Printing and publishing, book and job	74.3	85.8	22.7	13.2	3.0	1.0
Printing and publishing, newspapers and periodicals	76.9	88.7	20.3	10.6	2.8	0.7
Shirts	17.1	27.7	78.8	70.8	4.1	1.5
Silk and silk goods	32.5	47.1	58.2	48.9	9.3	4.0
Tobacco, cigars and cigarettes	55.4	70.8	40.8	27.9	3.8	1.3
Woolen goods	62.0	69.9	33.1	27.8	4.9	2.3
Worsted goods	46.4	57.6	44.0	37.7	9.6	4.7

[1] Less than one-tenth of 1 per cent.

The only industries employing considerable numbers of children were the five textile industries; also glass, shirts, and tobacco, cigars and cigarettes. Of these the most important was cotton goods, children forming 12.5 per cent of the number and receiving 6.2 per cent of the earnings.

Diagram 2 shows the deviation of the average earnings of all wage-earners and of men, women, and children in each of the 25 industries from the average earnings in all industries. The excess is shown by the lines to the left; the minus quantity by the lines to the right.

DIAGRAM 2.—CLASSIFIED WEEKLY EARNINGS, TWENTY-FIVE SELECTED INDUSTRIES—PER CENT THAT AVERAGE EARNINGS OF ALL WAGE-EARNERS, AND OF MEN, WOMEN, AND CHILDREN ARE ABOVE OR BELOW AVERAGE FOR UNITED STATES: 1905.



ANALYSIS OF SELECTED INDUSTRIES.

The use of the statistics for the 25 selected industries can best be illustrated by a brief analysis of the total for a few of the important ones, and the manufacture of boots and shoes, cotton goods, glass, pig iron (iron and steel, blast furnaces), and tobacco, cigars and cigarettes, have been selected for this purpose.

BOOTS AND SHOES.

During the last twenty-five years the utilization of machinery in the production of boots and shoes has greatly altered the number and character of the occupations in the industry. The introduction of labor saving devices has reduced the cost of the labor necessary for the manufacture of such products, and the use of easily operated machinery has made it possible to substitute women for men, and in some cases children for women. Machinery is now applied to practically every process in the production of boots and shoes, and in some factories as many as 100 well-defined operations are distinguished in the manufacture of the completed product from the first materials. The occupations followed in the production of the same grade of goods must be practically the same in the various factories that conduct all the operations. Specialization in the industry is, however, far advanced, and establishments manufacturing only cut stock—uppers and heels, etc.—are numerous. Such establishments are not included among those selected for the presentation of the statistics of classified earnings.

The production of boots and shoes was practically confined to the North Atlantic and the North Central divisions, although establishments manufacturing these products were located in 33 states and territories. The greatest number of wage-earners employed at any one time during the year in all the factories of the two divisions named formed 96.4 per cent of the greatest number engaged in the industry, as reported at the census of 1905.

At the census of 1905 no wage-earners were employed in 27 of the establishments reported. In some of these all of the labor was performed by the proprietors, and in others, convicts were employed exclusively. The convicts were not reported as wage-earners, but the amount paid for their labor was included as a part of the expenses of contract work. When these 27 establishments are omitted, 1,289 factories remain for consideration in connection with the study of the statistics of classified weekly earnings. Of this number, over one-half furnished satisfactory reports, the proportion of wage-earners represented being also greater than 50 per cent.

In the earnings of women this industry outranked every other of 25 selected industries for which statistics of classified earnings are presented by states and geographic divisions in Table 71. The earnings were high in the Western and the North Atlantic divisions and low in the two Southern divisions. A comparison of the two principal divisions shows that earnings of men, women, and children were higher in the North Atlantic than in the North Central division. The average weekly earnings of the men were $12.17 for the former division and $10.61 for the latter, the excess amounting to $1.56.

Of the states, Washington was foremost in total average earnings, but this high average has little effect upon the general average, for only a very small proportion of the wage-earners was employed there. The entire number, 24, were men, and consequently the average earnings for the state were greater than they would have been had women and children been employed.

TABLE 9.—*Boots and shoes—all establishments and greatest number of wage-earners, compared with number of establishments and wage-earners selected for classified earnings, by states, territories, and geographic divisions: 1905.*

STATE OR TERRITORY.	ESTABLISHMENTS.		WAGE-EARNERS.		
	Total number.	Number selected for classified earnings.	Greatest number employed at any one time during the year, all establishments.	Number in specified week, selected establishments.	
				Total.	Per cent of greatest number in all establishments.
United States	1,316	745	174,650	92,002	52.7
North Atlantic division	969	593	127,534	73,971	58.0
Maine	50	22	7,001	1,911	27.3
New Hampshire	50	24	12,226	4,956	40.5
Massachusetts	502	401	74,191	55,573	74.9
Connecticut	9	3	579	73	12.6
New York	188	71	19,086	7,064	37.0
New Jersey	51	21	4,483	929	20.7
Pennsylvania	119	51	9,968	3,465	34.8
South Atlantic division	21	9	842	350	41.6
Maryland	14	6	735	341	46.4
North Carolina	7	3	107	9	8.4
North Central division	242	104	40,845	16,228	39.7
Ohio	62	30	15,374	9,046	58.8
Indiana	4	3	296	261	88.2
Illinois	44	21	4,891	967	19.8
Michigan	23	11	2,000	547	27.4
Wisconsin	53	17	3,901	547	14.0
Minnesota	17	7	1,930	990	51.3
Iowa	5	3	550	178	32.4
Missouri	34	12	11,903	3,692	31.0
South Central division	15	8	520	48	9.2
Louisiana	10	4	474	25	5.3
Texas	5	4	46	23	50.0
Western division	26	17	956	460	48.1
Washington	5	3	137	24	17.5
California	21	14	819	436	53.2
All other states and territories	[1] 43	[2] 14	3,953	945	23.9

[1] Includes Colorado, 1; Delaware, 1; Georgia, 7; Indian Territory, 1; Kentucky, 9; Nebraska, 3; Oregon, 3; Rhode Island, 1; Tennessee, 4; Utah, 4; Vermont, 3; Virginia, 6.

[2] Includes Delaware, 1; Georgia, 2; Indian Territory, 1; Kentucky, 2; Nebraska, 1; Oregon, 2; Rhode Island, 1; Utah, 1; Vermont, 1; Virginia, 2.

Massachusetts, with 60.4 per cent of the wage-earners in the selected establishments, reported 66 per cent of the total earnings. It is not surprising, therefore, to find this state ranking high for the average earnings of each class of workers. In California and Missouri, also, the average earnings for each class were above the averages for the industry as a whole. The wages of the women in Massachusetts, California, Maine, New Hampshire, New York, Connecticut, and Louisiana were relatively higher than those of the men. The earnings of children were relatively higher than those of women or those of men in New Hampshire, California, Massachusetts, Wisconsin, Missouri, Michigan, New Jersey, Ohio, Iowa, and Pennsylvania.

There was a decided concentration of men at the higher earnings, 59.5 per cent receiving $10 or more for the representative week, but exclusive of Massachusetts there were only 48.1 per cent with these earnings.

TABLE 10.—BOOTS AND SHOES—NUMBER AND PER CENT DISTRIBUTION OF WAGE-EARNERS, FOR THE UNITED STATES, AND FOR MASSACHUSETTS; AND OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—BY CLASSIFIED WEEKLY EARNINGS, FOR THE UNITED STATES, EXCLUSIVE OF MASSACHUSETTS: 1905.

WEEKLY EARNINGS.	UNITED STATES.		MASSACHUSETTS.		UNITED STATES EXCLUSIVE OF MASSACHUSETTS.							
					All wage-earners.		Men 16 years and over.		Women 16 years and over.		Children under 16 years.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
The industry	92,002	100.0	55,573	100.0	36,429	100.0	22,452	100.0	12,247	100.0	1,730	100.0
Less than $3	3,235	3.5	1,125	2.0	2,110	5.8	595	2.7	823	6.7	692	40.0
$3 to $4	4,321	4.7	1,498	2.7	2,823	7.7	923	4.1	1,363	11.1	537	31.1
$4 to $5	5,553	6.0	2,357	4.2	3,196	8.8	1,219	5.4	1,604	13.1	373	21.6
$5 to $6	6,310	6.9	3,036	5.5	3,274	9.0	1,432	6.4	1,760	14.4	82	4.7
$6 to $7	7,353	8.0	4,036	7.3	3,317	9.1	1,704	7.6	1,575	12.9	88	2.2
$7 to $8	7,660	8.3	4,358	7.9	3,302	9.1	1,858	8.3	1,440	11.8	4	0.2
$8 to $9	7,251	7.9	4,278	7.7	2,973	8.2	1,823	8.1	1,146	9.3	[1] 4	0.2
$9 to $10	8,314	9.0	5,345	9.6	2,969	8.1	2,096	9.3	873	7.1		
$10 to $12	12,181	13.3	7,952	14.3	4,229	11.6	3,244	14.4	985	8.0		
$12 to $15	13,959	15.2	9,678	17.4	4,281	11.7	3,735	16.6	546	4.5		
$15 to $20	11,699	12.7	8,726	15.7	2,973	8.2	2,841	12.7	[2] 132	1.1		
$20 to $25	3,046	3.3	2,290	4.1	756	2.1	756	3.4				
$25 and over	1,120	1.2	894	1.6	226	0.6	226	1.0				
Earnings in the specified week:												
Total	$941,674		$621,169		$320,505		$233,512		$81,249		$5,744	
Average per wage-earner	$10.24		$11.18		$8.80		$10.40		$6.63		$3.32	

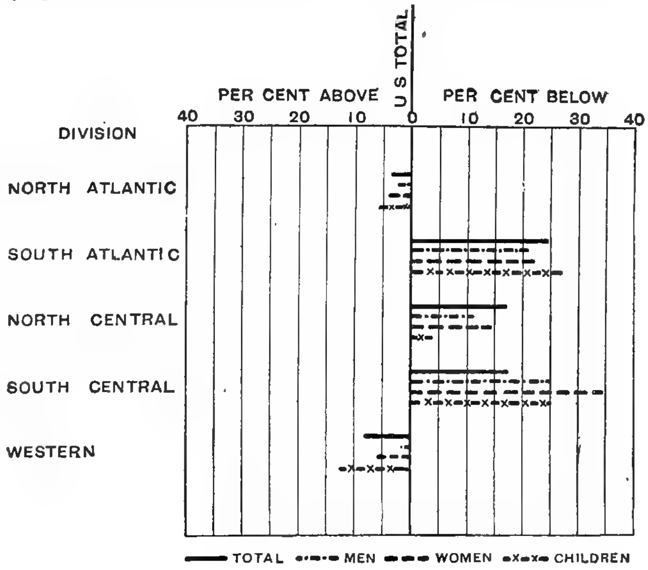
[1] $8 and over.

[2] $15 and over.

The total number of wage-earners, 55,573, reported for Massachusetts was 60.4 per cent of that shown for the industry in the entire country, and has such a marked effect on the proportion at the different amounts that it has been deemed advisable to show the proportions not only for the United States as a whole but for the United States exclusive of that state. The totals for Massachusetts omitted, there remain 36,429 wage-earners, of whom 22,452 are men, 12,247 women, and 1,730 children. The average weekly earnings for men, women, and children are considerably less than the averages based on totals which include Massachusetts and there is not such a pronounced concentration of the wage-earners at the higher amounts.

For all wage-earners and for each class the proportion of employees receiving the higher earnings was least, and the proportion at the lower, greatest in that portion of the country outside of Massachusetts. The distribution in the whole industry follows more closely that for the state of Massachusetts than that for the remaining portion of the country. The degree in which the statistics are representative, however, varies for the different sections of the country, being greatest for the North Atlantic division and least for the South Central.

DIAGRAM 3.—*Classified weekly earnings, boots and shoes—per cent that average earnings of all wage-earners, and of men, women, and children are above or below average for the United States, by geographic divisions: 1905.*



The proportion of men was considerably smaller and the proportion of women relatively greater than the corresponding proportions for all manufacturing industries in the United States. Over three-fourths of all wage-earners in all industries were men and about one-sixth were women, while less than two-thirds of those in the boot and shoe industry were men and about one-third were women.

TABLE 11.—*Boots and shoes—per cent distribution of men, women, and children, by states, territories, and geographic divisions: 1905.*

STATE OR TERRITORY.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.
United States	64.3	32.8	2.9
North Atlantic division	65.8	32.3	1.9
Maine	70.9	28.9	0.2
New Hampshire	64.7	33.6	1.7
Massachusetts	66.0	32.3	1.7
Connecticut	78.1	21.9	
New York	66.3	31.7	2.0
New Jersey	58.0	37.8	4.2
Pennsylvania	61.2	31.9	6.9
South Atlantic division	57.4	36.9	5.7
Maryland	56.6	37.8	5.6
North Carolina	88.9		11.1
North Central division	57.8	35.5	6.7
Ohio	56.7	38.1	5.2
Indiana	66.7	29.1	4.2
Illinois	58.5	35.1	6.4
Michigan	63.4	33.3	3.3
Wisconsin	64.9	28.5	6.6
Minnesota	65.8	33.0	1.2
Iowa	60.1	37.6	2.3
Missouri	55.3	31.8	12.9
South Central division	91.7	2.1	6.2
Louisiana	92.0	4.0	4.0
Texas	91.3		8.7
Western division	76.1	23.5	0.4
Washington	100.0		
California	74.8	24.8	0.4
All other states and territories	54.9	33.0	12.1

The South Atlantic division had the largest proportion of women. The North Central division ranked second in this respect and first in the relative number of children. Over nine-tenths of all the wage-earners in the South Central division and over three-fourths of those in the Western division were men.

The states leading in the proportion of women were Ohio, New Jersey, Maryland, Iowa, and Illinois. Missouri is prominent for a large proportion of children and a small proportion of men.

The presence of a large proportion of women has a tendency to reduce the average for the weekly earnings of all wage-earners. In spite of this tendency the average earnings of all wage-earners engaged in the production of boots and shoes, as well as those of each class of workers—men, women, and children—were greater than the corresponding averages for all industries.

In the Western division the largest number of men received from $15 to $20 for the week's work. In the two Northern divisions the largest numbers were paid from $12 to $15, but almost as many were paid from $15 to $20. In the Southern divisions comparatively few received over $15.

COTTON GOODS.

Of the plants engaged in the manufacture of cotton goods, those of medium or large size furnished the most reliable returns concerning classified earnings, as these establishments keep the most accurate pay rolls. The statistics that follow are based upon the data presented in these selected schedules, and therefore for the most part deal with the most nearly representative establishments engaged in the industry in the various sections of the country. This fact renders the comparisons of far greater value than would be the case if numerous small establishments were included, since such establishments are often conducted under conditions not at all typical of the entire industry in the section of the country in which they are located.

TABLE 12.—*Cotton goods—all establishments and greatest number of wage-earners, compared with number of establishments and wage-earners, selected for classified earnings, by states and geographic divisions: 1905.*

STATE.	ESTABLISHMENTS.		WAGE-EARNERS.		
	Total number.	Number selected for classified earnings.	Greatest number employed at any one time during the year, all establishments.	Number in specified week, selected establishments.	
				Total.	Per cent of greatest number in all establishments.
United States	1,077	525	351,415	202,211	57.5
North Atlantic division	495	262	204,423	133,361	65.2
Maine	15	7	13,539	4,666	34.5
New Hampshire	25	5	21,281	10,117	47.5
Massachusetts	142	109	100,982	85,353	84.5
Rhode Island	73	42	23,712	13,854	58.4
Connecticut	49	20	13,947	7,499	53.8
New York	30	9	9,707	1,330	13.7
New Jersey	17	10	5,764	3,154	54.7
Pennsylvania	144	60	15,491	7,388	47.7
South Atlantic division	454	215	116,805	56,494	48.4
Maryland	12	4	4,254	2,799	65.8
North Carolina	212	106	42,142	20,830	49.4
South Carolina	127	62	42,950	20,933	48.7
Georgia	103	43	27,459	11,932	43.5
North Central division	5	4	1,596	1,052	65.9
Indiana	5	4	1,596	1,052	65.9
South Central division	76	30	18,089	8,559	47.3
Tennessee	16	6	2,816	1,557	55.3
Alabama	46	19	12,834	5,995	46.7
Mississippi	14	5	2,439	1,007	41.3
All other states	[1]47	[2]14	10,502	2,745	26.1

[1] Includes Arkansas, 2; California, 1; Delaware, 1; Illinois, 2; Kentucky, 4; Louisiana, 3; Missouri, 1; Ohio, 3; Texas, 13; Vermont, 4; Virginia, 10; Wisconsin, 3.

[2] Includes Arkansas, 1; Illinois, 1; Kentucky, 2; Louisiana, 1; Ohio, 1; Texas, 2; Vermont, 2; Virginia, 2; Wisconsin, 2.

Of the total number of establishments in the United States manufacturing cotton goods at the census of 1905, almost one-half were selected for the tabulation of classified weekly earnings. The number of wage-earners employed in these establishments comprised

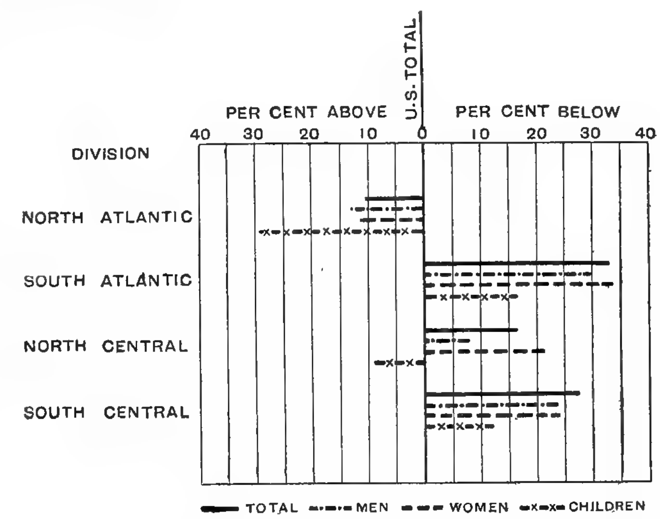
57.5 per cent of the greatest number employed at any one time in all establishments in this industry. The North Atlantic and the North Central divisions are represented by nearly two-thirds of their wage-earners, a proportion larger than that of any other division. Of individual states in the North Atlantic division, Massachusetts leads with over four-fifths, and Rhode Island, New Jersey, and Connecticut follow with little more than one-half. The proportion shown for the other important cotton manufacturing states except Maine, North and South, approaches 50 per cent. The only state for which the statistics can not be said to be representative is New York; not one-seventh of its operatives are included.

As a rule cotton goods are produced on a much larger scale in the average mill in the North than in the average mill in the South. The numerous small yarn factories scattered through North Carolina, South Carolina, and Georgia are largely responsible for the wide difference. Many of these factories employ less than 100 operatives, and the wage-earners are for the most part women and children. In the North, on the other hand, the manufacture of cotton yarns is concentrated in a comparatively few mills, and some of these are of the largest size. For each geographic division of the country, however, the establishments that were selected for the study of classified earnings are representative of all the plants within the area, so far as the conditions that govern the earnings of operatives are concerned, and figures for the establishments within the limits of each section are comparable.

Table 71 shows that during the representative week of the establishments selected, the average earnings for all classes of operatives engaged in the production of cotton goods in the United States were $6.47. For the men, the average was $7.71; for the women, $6.03; and for the children, $3.21. In the case of both the men and the women the greatest number earned between $6 and $7. While the proportion of women in this group was greater than the proportion of the men, 17.4 per cent of the men and only 4.1 per cent of the women were reported as earning from $10 to $15. Three-fourths of the children earned less than $4, and nearly one-half (45.2 per cent) earned less than $3 per week.

In the tabulation of the classified earnings of each class of wage-earners, 8 of the states in the North Atlantic division are shown to have employed 67.9 per cent of the men, 73.4 per cent of the women, and 34.8 per cent of the children engaged in the manufacture of cotton goods. The division next in importance in number of wage-earners was the South Atlantic, which is shown as comprising 4 states, of which 3 are the states leading in the industry in the South. The children employed in the cotton mills of this division formed over one-half of all the children in the industry. The contrast between the cotton mills in these two divisions in the proportions that the men, women, and children formed of the total number of wage-earners employed in each division and in the distribution of each group of wage-earners according to amounts of earnings is most marked. In the establishments in the North Atlantic division 48.3 per cent of the operatives were men, 45.1 per cent were women, and 6.6 per cent were children; whereas in the South Atlantic division 45.1 per cent of the operatives were men, 30.5 per cent were women, and 24.4 per cent were children. In the North Atlantic division 77.7 per cent of the men received from $6 to $15, and their distribution among the six classes of earnings included within this range of rates was fairly uniform. In contrast to this is the earning capacity of the men in the cotton mills of the South Atlantic division, only 35.2 per cent of whom earned these amounts. A similar wide disparity is noticeable in the earnings of the women in the two sections of the country. Of the total number of women employed in the North Atlantic division, 70.5 per cent earned from $5 to $9, whereas in the South Atlantic division only 22.9 per cent received the like amounts. Of the large number of children employed in the latter division, 60.7 per cent earned less than $3, while in the former division only 15.2 per cent were returned in this group.

DIAGRAM 4.—*Classified weekly earnings, cotton goods—per cent that average earnings of all wage-earners, and of men, women, and children are above or below average for the United States, by geographic divisions: 1905.*



In the case of the 5 New England states shown separately in Table 71 there are no remarkable variations in the distribution of the men and the women among the different amounts of earnings. These states include the greatest centers for the manufacture of cotton goods, and the conditions regulating wages within their borders are fairly uniform. In the case of children there are some wider variations, due in large part to differences in the laws and usages concerning the employment of child labor..

When, however, New York, Pennsylvania, and New Jersey are compared with the New England

states some wide differences are observable. For instance, the average earnings of the men were considerably higher for New Jersey than for any of the New England states. This is due to the inclusion in the selected establishments for New Jersey of several large thread factories which spin the finest counts of yarn, and hence require a highly skilled class of wage-earners in nearly every department. In like manner differences in the kinds of products manufactured account for a number of variations observable in the distribution by classes of earnings of the men and the women in New York and Pennsylvania and those in the New England states.

Specialization in the manufacture of the various products of the cotton fiber is marked. Some factories confine themselves to the production of cotton yarns; others make only plain cotton cloths for printing and converting; others produce twills and sateens and fancy woven fabrics that require the finer counts of yarn; while others manufacture other varieties of the products of the industry. It is evident that mills that produce fine woven goods must employ a higher grade of skill than those that spin coarse counts of yarn. The finer grade of goods forms a much larger proportion of the total product of the cotton industry in the North than in the South, and it follows that the percentage of skilled labor in the former section of the country is necessarily greater than that in the latter. Thus, while Table 71 shows that the earnings of all the cotton mill operatives in the New England states were much higher than those of the wage-earners in the cotton mills of the South, it does not furnish data for a comparative study of the earnings of operatives employed in the production of the same grade of goods in these two sections. Such a comparison is presented in Table 13, which shows the earnings of the men, women, and children employed as wage-earners in selected establishments engaged in the production of cotton yarns, or in the manufacture of plain cloths for printing and converting.

The average weekly earnings of the men in the 11 establishments selected to represent the production of cotton yarns in New England amounted to \$8.22, or \$3.10 more than the average for the men employed in the 45 selected establishments manufacturing the same products in the Southern states. In the case of women the average weekly earnings in the same establishments in New England were \$5.88, or \$2.12 more than the average for operatives of this class in the selected mills of the South. The children employed in the northern mills earned on an average \$4.60 a week, which was \$2.06 more than the average earnings of the children in the southern mills shown in the table.

In the 45 southern mills producing cotton yarn, nearly one-third (31.7 per cent) of the total number of men employed earned from \$4 to \$5 during the representative week reported, and over one-half (57.1 per cent) earned less than \$5. In the northern mills, on the other hand, the marked concentration began in the group of wages ranging from \$6 to \$7 and continued through the two succeeding groups; these three groups, covering the operatives earning from \$6 to \$9, contained 44.9 per cent of the total number of men employed.

TABLE 13.—*Comparison of classified earnings in selected establishments manufacturing cotton yarns and plain cloths for printing and converting, in New England and the Southern states: 1905.*

	COTTON YARNS.		PLAIN CLOTHS FOR PRINTING AND CONVERTING.	
	New England states.	Southern states.	New England states.	Southern states.
Number of establishments	11	45	17	11
Average weekly earnings:				
All wage-earners	\$6.93	\$3.95	\$7.62	\$4.16
Men 16 years and over	\$8.22	\$5.12	\$8.52	\$5.14
Women 16 years and over	\$5.88	\$3.76	\$7.23	\$3.77
Children under 16 years	\$4.60	\$2.54	\$4.45	\$2.73
Wage-earners and earnings for selected week:				
Total number	6,949	6,606	16,775	6,508
Total earnings	\$48,178	\$26,087	\$127,787	\$27,047
Men 16 years and over—				
Number	3,456	2,644	8,157	3,102
Earnings	\$28,403	\$13,546	\$69,477	\$15,930
Per cent distribution—				
Less than \$3	6.6	8.1	0.9	14.5
\$3 to \$4	2.7	17.3	2.1	14.3
\$4 to \$5	6.2	31.7	4.2	18.4
\$5 to \$6	8.6	16.4	8.5	20.9
\$6 to \$7	19.4	12.7	15.0	11.3
\$7 to \$8	15.3	4.6	13.8	7.5
\$8 to \$9	10.2	2.9	13.3	5.4
\$9 to \$10	7.0	2.5	12.5	4.2
\$10 to \$12	6.6	1.2	16.5	1.3
\$12 to \$15	7.6	1.6	9.2	0.7
\$15 to \$20	8.1	0.8	2.7	0.8
\$20 to \$25	1.2	(1)	1.2	0.6
\$25 and over	0.5	0.2	0.1	0.1
Women 16 years and over—				
Number	2,891	2,029	7,818	1,805
Earnings	\$17,007	\$7,623	\$56,547	\$6,813
Per cent distribution—				
Less than \$3	7.3	16.2	1.5	26.6
\$3 to \$4	6.3	40.5	5.4	22.4
\$4 to \$5	10.2	29.9	9.3	23.6
\$5 to \$6	15.8	8.7	14.9	19.7
\$6 to \$7	25.1	3.6	15.1	5.1
\$7 to \$8	18.5	1.0	17.4	1.9
\$8 to \$9	10.6	0.1	15.4	0.6
\$9 to \$10	4.2	(1)	12.2	....
\$10 to \$12	2.0	....	8.7	....
\$12 to \$15	(1)	....	0.1	0.1
\$15 and over	....	....	(1)	....
Children under 16 years—				
Number	602	1,933	800	1,601
Earnings	\$2,768	\$4,918	\$3,563	\$4,376
Per cent distribution—				
Less than \$3	12.1	66.9	15.4	58.8
\$3 to \$4	25.7	26.1	31.9	25.0
\$4 to \$5	27.9	5.9	23.6	14.0
\$5 to \$6	15.1	1.1	11.6	1.8
\$6 to \$7	14.0	....	11.7	0.3
\$7 to \$8	4.2	....	3.8	0.1
\$8 and over	1.0	....	2.0	....

[1] Less than one-tenth of 1 per cent

The comparatively large proportion of men in the wage groups from \$9 upward in the New England spinning mills was due in large part to the size of the mills. The large number of wage-earners employed in the northern mills made necessary a numerous supervisory force of boss spinners, assistant foremen, and overseers, whose remuneration was considerably higher than that of the ordinary operative; whereas in the southern mills, the supervisory force was small and often consisted of the owners, who were not reported as wage-earners.

Of the women employed in the southern spinning mills, 56.7 per cent earned less than $4 during the week reported for the selected establishments, while in the northern mills over one-fourth of the total number earned from $6 to $7, and 43.6 per cent earned from $6 to $8.

Children formed a much larger proportion of the total number of wage-earners in the southern spinning mills than in the northern. Out of 6,606 operatives reported by the 45 southern mills, 1,933, or 29.3 per cent, were children, while of the total number employed in the New England mills, only 602, or 8.7 per cent, were under 16 years of age. Of the large proportion of children employed in the southern mills, over two-thirds (66.9 per cent) earned less than $3 per week and 93.1 per cent received less than $4. In the New England mills, on the other hand, 53.7 per cent of the total number of children earned from $3 to $5, over one-half of the number receiving these rates of earnings being paid from $4 to $5, while 34.2 per cent of the total number of children employed earned $5 or more.

In the spinning mills of New England the average weekly earnings of an average wage-earning unit, embodying all grades of skill, both sexes, and all ages, were $6.93, whereas in the Southern states the average for such an imaginary unit was $3.95, or $2.98 less than the amount paid in New England.

For the manufacture of plain cloths for printing and converting only those mills were selected that performed all the processes from the first treatment of the raw cotton to the completion of the finished product. It was possible therefore to obtain data relative to conditions of manufacture that, so far as the processes and kind of machinery employed were concerned, were necessarily similar for the two sections of the country shown. A comparison of the weekly earnings of each class of wage-earners employed in the North and the South in the production of this grade of cotton goods is, therefore, highly significant, indicating as it does the difference between the two sections in the cost of the labor required for the production of the same class of cotton goods.

In New England the average weekly earnings of the wage-earners in the 17 factories shown in Table 13 were $8.52 for men, $7.23 for women, and $4.45 for children. These averages present marked contrasts to those for the 11 mills in the South, in which men earned an average of only $5.14 weekly; women, only $3.77; and children, only $2.73. When the average earnings for a composite wage-earner representing all grades of skill, different ages, and both sexes, are computed for the two sections, the difference between the labor cost in the production of the class of goods under consideration is still further accentuated. In the mills in the North the average weekly earnings were $7.62, or $3.46 more than the average for the mills in the South. A leading cause for this disparity lies in the fact that in the 11 southern mills children formed nearly one-fourth (24.6 per cent) of the total number of operatives employed, while in the 17 northern mills they formed not quite one-twentieth (4.8 per cent) of the total number.

For the southern mills the concentration of men is shown to have been in the lowest four groups of earnings, and only 31.9 per cent received $6 and over, whereas in the northern mills 84.3 per cent received $6 and over. In the earnings of women an even wider disparity appears, for while 68.9 per cent of the number employed in the northern mills received $6 or over, only 7.7 per cent of those in the southern mills were equally fortunate. In this connection it is noteworthy that over one fourth (27.6 per cent) of the total number of women in the northern mills earned from $8 to $10, while only six-tenths of 1 per cent of women in the southern mills earned from $8 to $9.

The earnings of children in the southern mills evidently were extremely low, since 58.8 per cent of the number shown in the table received less than $3. In the case of the northern mills the principal concentration occurred in the two groups of earnings from $3 to $5, for which 55.5 per cent of the total number of children were reported.

GLASS.

There is a great difference in the number of wage-earners engaged in the manufacture of glass at different seasons of the year. In 1905 the average number employed during April was 74,316 and the average for July was 28,246. The greatest number employed at any one time during the year was 87,586.

The average number of wage-earners employed in all establishments during the entire year was 63,969, and of this total the number reported for the specified week by the establishments for which statistics of classified earnings are presented forms 56.9 per cent. It is probable that in the majority of cases, the week for which the detailed statement of earnings was furnished was a week during the busy season of the year, and therefore in Table 14 a comparison is made between the greatest number of wage-earners employed at any one time in all establishments and the number employed in the factories included for the specified week.

While glass factories were in operation in a number of the states, the industry was largely centered in New Jersey, Pennsylvania, Ohio, Indiana, and Illinois. The greatest number of wage-earners employed in the factories in these states at any one time during the year was 70,126, or 80.1 per cent of the greatest number employed in all states. In the statistics of classified earnings, however, the state of Illinois is not given proper weight in determining the general average earnings for the United States, since only a small proportion of the number employed in the state is included.

TABLE 14.—*Glass—all establishments and greatest number of wage-earners, compared with number of establishments and wage-earners, selected for classified earnings, by states and geographic divisions: 1905.*

STATE.	ESTABLISHMENTS.		WAGE-EARNERS.		
	Total number.	Number selected for classified earnings.	Greatest number employed at any one time during the year, all establishments.	Number in specified week, selected establishments.	
				Total.	Per cent of greatest number in all establishments.
United States	399	171	87,586	36,368	41.5
North Atlantic division	176	79	40,341	19,467	48.3
Massachusetts	4	3	998	978	98.0
New York	28	12	4,142	2,348	56.7
New Jersey	22	5	7,358	1,655	22.5
Pennsylvania	122	59	27,843	14,486	52.0
South Atlantic division	45	22	6,104	2,735	44.8
Maryland	6	3	995	634	63.7
West Virginia	39	19	5,109	2,101	41.1
North Central division	161	66	37,978	13,700	36.1
Ohio	37	12	11,130	3,393	30.5
Indiana	96	42	17,029	7,531	44.2
Illinois	13	3	6,766	886	13.1
Missouri	6	3	1,886	986	52.3
Kansas	9	6	1,167	904	77.5
All other states	[1] 17	[2] 4	3,163	466	14.7

[1] Includes California, 4; Colorado, 1; Delaware, 1; Georgia, 1; Indian Territory, 1; Michigan, 2; South Carolina, 1; Tennessee, 1; Virginia, 4; Wisconsin, 1.
[2] Includes California, 1; Michigan, 1; Tennessee, 1; Virginia, 1.

Most of the occupations in the industry are well-defined and frequently the rates of wages are established by agreement. The practice of paying by the piece prevails largely, especially in the case of skilled workmen. The degree of skill and the amount of physical endurance required of the operatives, and consequently their earnings, depend to a great extent on the class of products made. In some branches of the industry machinery is used extensively. Naturally relative efficiency, application, lost time, and other factors that affect the earnings in all industries should be taken into consideration in a study of the statistics.

The manipulation of the "metal" is performed almost exclusively by men. In some branches of the industry, especially in the production of small ware, women and children are employed as helpers and in decorating, assorting, selecting, and packing the finished products.

The proportions of men and children employed in the glass factories were large and the proportion of women was small in comparison with the corresponding proportions for the wage-earners in all manufacturing establishments in the United States. The percentages for all industries were 77.6 for men, 19.5 for women, and 2.9 for children; those for glass are shown in Table 15.

TABLE 15.—*Glass—per cent distribution of men, women, and children, by states and geographic divisions: 1905.*

STATE.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.
United States	86.7	4.7	8.6
North Atlantic division	86.7	4.3	9.0
Massachusetts	86.8	10.5	2.7
New York	90.8	4.0	5.2
New Jersey	86.5	2.0	11.5
Pennsylvania	86.0	4.3	9.7
South Atlantic division	83.1	7.3	9.6
Maryland	85.2	1.9	12.9
West Virginia	82.4	8.9	8.7
North Central division	87.5	4.7	7.8
Ohio	79.5	8.3	12.2
Indiana	90.5	3.6	5.9
Illinois	77.4	3.2	19.4
Missouri	95.6	1.0	3.4
Kansas	94.1	5.7	0.2
All other states	80.2	6.9	12.9

The proportion of men among the wage-earners was largest in Missouri and smallest in the neighboring state of Illinois. This difference is explained in part by the fact that window glass and similar products, in the manufacture of which men are employed almost exclusively, were made in Missouri, while Illinois is represented in the industry only by establishments producing the smaller wares and employing women and children to a greater extent.

In the latter state almost one-fifth of all the wage-earners in the glass factories were children. This class formed over one-eighth of all the glassworkers in Maryland, a state with establishments manufacturing bottles and jars, in the production of which the proportion of children employed is large. New Jersey also, making such products exclusively, had a large proportion of children.

The largest proportion of women is shown for Massachusetts, in which state 2 out of the 3 establishments made tableware, thus furnishing a considerable amount of work that is suitable for women.

The distribution of the women and children in the various glass producing states differs considerably from that of the total number of glassworkers. Both classes were relatively numerous in Ohio and relatively small in Indiana, while in Pennsylvania the proportion of children was large and that of women small.

It is interesting to note that the states with a large proportion of women were the states with the greatest number of wage-earners in the branch of the industry manufacturing tableware and similar products, and the states with a small proportion either had no establishment making tableware or had comparatively few wage-earners in this branch of the industry.

Of the 25 selected industries for which statistics are given by states, territories, and geographic divisions, in Table 71, glass was first in average earnings of the

men employed during the specified week and fourth in the earnings of the children. In the amount paid to women only 1 industry, that of iron and steel, blast furnaces, was lower.

The average earnings of the wage-earners employed in the selected establishments during the specified week were highest in Kansas, with Illinois and West Virginia following in rank. Massachusetts, Missouri, Indiana, and New York were the only states with earnings less than the average for all of the selected establishments.

The difference in the earnings in Kansas and Massachusetts is explained in part by the difference in the class of products manufactured. The establishments in the former state made a specialty of window and blown glass ware, products for which the highest earnings were reported; while those in the latter state manufactured principally tableware, lamps, etc., products for which the lowest wages prevailed. Another partial explanation may be found in the larger proportion of men employed in Kansas.

Since men predominated in the industry and their earnings were much greater than the earnings of women and children, it is not surprising to find that the groups of states at the extremes in rank were the same for men as for all wage-earners. The order of the states of high rank, however, differs in that Illinois held first place, with West Virginia and Kansas following.

Pennsylvania, Massachusetts, and New York, states of the North Atlantic division, led in the average earnings of the women employed, while Illinois, Indiana, and Missouri, of the North Central division, led in the averages for children.

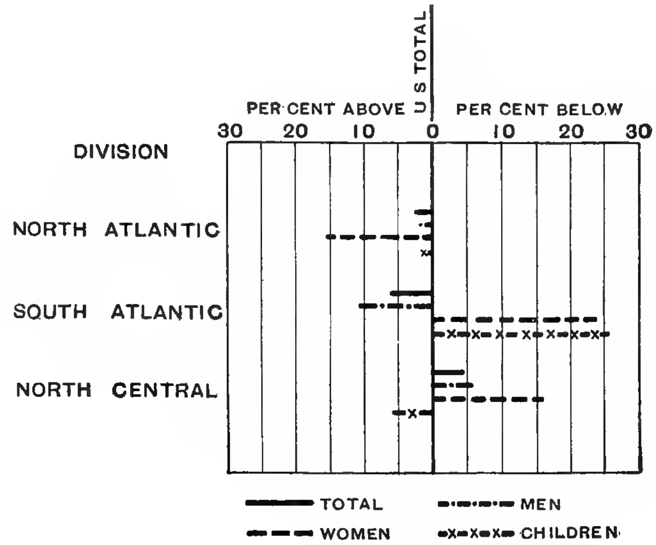
In the South Atlantic division the earnings were relatively high for men and low for women and children; in the North Atlantic division they were a little above the average for men and children and high for women; and in the North Central division they were below the average for men, low for women, and high for children.

The glass industry was foremost among the 25 selected industries in the concentration of men at the highest amount of earnings.

Of the 3 geographic divisions shown, the South Atlantic is credited with the greatest proportion of men at the highest amounts of earnings. This fact is not so significant as might be supposed, however, for only 2 states and a comparatively small number of wage-earners are included. The least concentration at the higher amounts is shown for the North Atlantic division, in which over one-half of the men in the industry were employed. The average earnings for this division, however, were exceeded only by those for the South Atlantic states.

While for each division the median group of earnings for men was $10 to $12, the median for women varied, being $5 to $6 for the North Atlantic division, $4 to $5 for the North Central, and $3 to $4 for the South Atlantic.

DIAGRAM 5.—*Classified weekly earnings, glass—per cent that average earnings of all wage-earners, and of men, women, and children are above or below average for the United States, by geographic divisions: 1905.*



For children the median was $3 to $4 for the South Atlantic division, and $4 to $5 for the other divisions. The medians for children in the North Central and the North Atlantic divisions were greater than the medians for women in the North Central and the South Atlantic divisions.

The largest proportion of men at the highest amount was reported for Illinois. Kansas, another of the North Central states, ranked next, while Missouri, a third state in the division, was lowest in rank in this respect, although its median was higher than that of Illinois. These facts may be explained in part by the absence in Missouri of establishments making bottles and jars, in which branch of the industry the proportion of high earnings is large, and the absence in Illinois of factories making window and other plate glass, products commanding higher average earnings but with comparatively few wage-earners at the highest amount. West Virginia was the only state with a median of earnings of at least $12.

Many kinds of glass are produced, and naturally the requirements and the earnings of the operators in the various factories depend to a great extent upon the class of products manufactured. Since this is the case, statistics for the establishments are presented in 3 groups, the classification of the factories being as follows: (1) Those engaged primarily in the manufacture of window, plate, and other varieties of cast and rolled sheet glass; (2) those that manufacture bottles and jars; (3) those that make a specialty of tableware, lamps, chimneys, lantern globes, electric and opal ware, and cut glass.

The bottle and jar branch of the industry was the most widespread. All except 2 of the states were reported as engaged in manufacturing bottles and jars, and in 5 states—New Jersey, Maryland, Virginia,

Tennessee, and California—all the glass factories were producing an output of this class. Tableware glass and similar products were reported as the specialty of the establishment in Michigan. Both tableware and bottle glass were made in Massachusetts and Illinois, while tableware and window glass were produced in Missouri. All three classes of products were reported for 6 states—New York, Pennsylvania, West Virginia, Ohio, Indiana, and Kansas.

TABLE 16.—*Glass—average weekly earnings and per cent distribution of wage-earners—men, women, and children—by classified weekly earnings, and by class of products: 1905.*

	Total.	Window, plate, and other cast and rolled sheet glass.	Bottles and jars.	Tableware, lamps, chimneys, globes, opal ware, and cut glass.
Number of establishments	171	[1] 61	[2] 64	[3] 46
Average weekly earnings:				
All wage-earners	$12.82	$14.94	$13.14	$10.41
Men 16 years and over	$14.10	$15.02	$14.80	$12.18
Women 16 years and over	$5.08	$6.07	$4.81	$5.11
Children under 16 years	$4.22	$5.83	$4.31	$4.03
Wage-earners and earnings for selected week:				
Total number	36,368	12,209	11,903	12,256
Total earnings	$466,343	$182,349	$156,428	$127,566
Men 16 years and over—				
Number	31,510	12,099	10,011	9,400
Earnings	$444,361	$181,701	$148,152	$114,508
Per cent distribution—				
Less than $3	1.8	0.2	2.4	3.2
$3 to $4	2.5	0.3	4.8	2.7
$4 to $5	4.7	0.4	7.0	7.7
$5 to $6	5.3	0.3	8.6	8.1
$6 to $7	5.4	1.3	8.7	7.1
$7 to $8	5.8	4.4	7.9	5.4
$8 to $9	6.2	7.6	6.0	4.7
$9 to $10	10.6	14.8	9.0	7.1
$10 to $12	12.8	21.4	5.5	9.4
$12 to $15	11.5	15.9	4.7	13.1
$15 to $20	10.9	12.8	5.1	14.8
$20 to $25	7.5	7.6	4.7	10.5
$25 and over	15.0	13.0	25.6	6.2
Women 16 years and over—				
Number	1,721	27	258	1,436
Earnings	$8,738	$164	$1,241	$7,333
Per cent distribution—				
Less than $3	9.9	....	9.3	10.2
$3 to $4	21.7	3.7	20.9	22.2
$4 to $5	25.0	14.8	28.7	24.6
$5 to $6	14.7	11.1	26.7	12.6
$6 to $7	11.7	59.3	7.4	11.6
$7 to $8	6.7	....	1.9	7.7
$8 to $9	3.5	11.1	1.2	3.8
$9 to $10	2.9	....	0.4	3.3
$10 to $12	1.7	....	1.5	1.7
$12 to $15	1.4	....	1.2	1.5
$15 and over	0.8	....	0.8	0.8
Children under 16 years—				
Number	3,137	83	1,634	1,420
Earnings	$13,244	$484	$7,035	$5,725
Per cent distribution—				
Less than $3	13.0	2 4	9.6	17.5
$3 to $4	30.4	12.1	30.5	31.4
$4 to $5	30.1	4.8	36.0	24.7
$5 to $6	14.8	22.9	13.1	16.2
$6 to $7	9.0	51.8	6.7	9.3
$7 to $8	1.2	2.4	2.1	0.1
$8 and over	1.5	3.6	2.0	0.8

[1] Includes Indiana, 12; Kansas, 3; Missouri, 2; New York, 4; Ohio, 2; Pennsylvania, 29; West Virginia, 9.
[2] Includes California, 1; Illinois, 2; Indiana, 20; Kansas, 1; Maryland, 3; Massachusetts, 1; New Jersey, 5; New York, 5; Ohio, 4; Pennsylvania, 15; Tennessee, 1; Virginia, 1; West Virginia, 5.
[3] Includes Illinois, 1; Indiana, 10; Kansas, 2; Massachusetts, 2; Michigan, 1; Missouri, 1; New York, 3; Ohio, 6; Pennsylvania, 15; West Virginia, 5.

The number of wage-earners is quite evenly distributed among the three groups, the percentages being 33.7 for the factories producing tableware glass, 33.6 for those manufacturing window and plate glass, and 32.7 for those making bottles and jars. The corresponding percentages for the earnings for the week are 27.4, 39.1, and 33.5. It is seen, therefore, that the variation in proportional earnings was considerable. Although the group of establishments producing tableware glass employed the greatest number of wage-earners, they paid the smallest amount in earnings.

Men formed over three-fourths of the wage-earners in each of the three groups of establishments. The excess of men was most pronounced in the manufacture of window and sheet glass, in which branch of the industry the women and children formed less than 1 per cent.

The greatest number of women—more than four-fifths of all the women glassworkers—were employed in factories making tableware glass and similar products. The number of children in these establishments was almost as great as the number of women. The largest number of children was reported for the production of bottles and jars. The children in this branch of the industry formed over one-half of all the children employed in the manufacture of glass products.

Since the average earnings for men are so much greater than the averages for women and children, it is not surprising that the order of the three branches of the industry for average earnings should follow that for the proportion of men employed.

The median for men was between $10 and $12 for the entire industry and for each branch except that producing bottles and jars. Although the establishments manufacturing such products reported the largest proportion of men at the highest rate of earnings, the median was low, being between $9 and $10. In this branch of the industry blowers and gatherers were pieceworkers and were paid high rates, but the number of wage-earners receiving lower earnings was larger proportionately than the number of such employees in the other branches of glassmaking.

In the case of women and children the median was highest for the wage-earners making window and other sheet glass. There were only 27 women reported as engaged in this branch of glassmaking, but none received over $9 for the week, although in each of the other branches a few women received $15 and over.

IRON AND STEEL, BLAST FURNACES.

Under the classification iron and steel, blast furnaces, 190 establishments were reported as in operation in the United States at the census of 1905. The returns of 82 of these, or 43.2 per cent of the total number, furnished, in satisfactory form, data relating to the weekly earnings of the wage-earners employed. The distribution of these 82 establishments by states and geographic divisions, and the relative completeness with which they typify or represent conditions obtaining in the 190 establishments engaged in pig iron manufacture, are indicated in Table 17.

TABLE 17.—*Iron and steel, blast furnaces—all establishments and greatest number of wage-earners, compared with number of establishments and wage-earners, selected for classified earnings, by states and geographic divisions: 1905.*

STATE.	ESTABLISHMENTS.		WAGE-EARNERS.		
	Total number.	Number selected for classified earnings.	Greatest number employed at any one time during the year, all establishments.	Number in specified week, selected establishments.	
				Total.	Per cent of greatest number in all establishments.
United States	190	82	47,361	23,839	50.3
North Atlantic division	74	35	20,265	11,657	57.5
New York	[illegible]	6	2,127	1,114	52.4
Pennsylvania	65	29	18,138	10,543	58.1
South Atlantic division	10	5	1,384	748	54.0
Virginia	10	5	1,384	748	54.0
North Central division	48	25	10,013	6,013	60.1
Ohio	33	17	7,817	4,984	63.8
Michigan	11	5	1,517	508	33.5
Wisconsin	4	3	679	521	76.7
South Central division	32	7	8,698	2,104	24.2
Tennessee	13	3	2,103	490	23.3
Alabama	19	4	6,595	1,614	24.5
All other states	[1] 26	[2] 10	7,001	3,317	47.4

[1] Includes Colorado, 1; Connecticut, 2; Georgia, 4; Illinois, 4; Kentucky, 1; Maryland, 2; Massachusetts, 1; Minnesota, 1; Missouri, 2; New Jersey, 5; West Virginia, 3.
[2] Includes Connecticut, 1; Illinois, 2; Maryland, 2; Missouri, 1; New Jersey, 1; West Virginia, 3.

When it is considered that more than one-half of the greatest number of wage-earners engaged in the entire industry at any one time are covered by the selected returns summarized in the table, the representative character of the statistics presented becomes apparent. In fact, an even smaller proportion of the total number of returns, if judiciously distributed, would afford a sufficiently broad basis for the intelligent analysis of the weekly earnings in this industry, for the reason that the diversification in the products of blast furnaces is very slight, and consequently the returns for a relatively small number of establishments represent all the manufacturing processes peculiar to the industry and all the grades of skill required by them.

Local influences affecting weekly earnings that are peculiar to certain states or geographic divisions are amply covered in the distribution. In each of the leading iron producing states, with the exception of Alabama, more than one-half of the total number of wage-earners in the industry are included.

In the two leading states in pig iron manufacture, namely, Pennsylvania and Ohio, whose combined output was valued at 64 per cent of the total value of such products at the census of 1905, the proportion of wage-earners carried on the selected returns comprises nearly two-thirds of the total number employed in the selected establishments.

The manufacture of iron and steel, represented by the two classifications, "blast furnaces" and "steel works and rolling mills," has become one of the most localized of the leading branches of manufacture, and in certain neighborhoods it has been distinctly specialized. An important factor in bringing about these conditions in the production of pig iron is the increased use of coke as a fuel in blast furnaces. This employment of coke, which has practically supplanted the use of charcoal and anthracite as furnace fuel, has been followed logically by a concentration of the pig iron industry in the vicinity of the principal bituminous coal fields of the country.

This marked localization and specialization in the industry would seemingly tend toward similarity in conditions, methods, and practices, and promote such general harmony in the classification and pay of wage-earners as would make their average weekly earnings, at least in the same general locality, approximate a common level. An inspection of the statistics shows, however, a considerable range in the earnings, not only for the several geographic groups, but also for states in the same group. Numerous causes contribute in different degrees to this variation, one of the most important of which is the difference in the length of the working period. In many establishments the day is divided into two shifts of twelve hours each, while in others the division is into three periods, the turn or working day of the wage-earner being eight hours in length. Such a decided variation in the length of the working day in different plants naturally results in a substantial disparity between the earnings. Since the inquiry relating to earnings did not, in the returns from many blast furnaces, elicit definite information concerning the duration of a shift or turn, it was not practicable to make such eliminations as would render the establishments selected for consideration homogeneous in this respect.

Another factor that appreciably affects the earnings arises from the difference in the methods of disposing of the molten iron product after it has been drawn from the stack. Formerly the common practice was to cast on a sand bed. During recent years, however, many of the larger establishments have installed casting machines, which receive the molten metal from the furnace and automatically deliver it in the form of pig iron, thus eliminating much of the manual labor involved in the sand casting method. A further saving in the same class of labor is effected in many establishments by the delivery of the metal in a molten state to steel plants for use in Bessemer converters, open hearth furnaces, etc., thus eliminating entirely the process of casting. The number of men formerly required to operate a typical blast furnace has been still further reduced in many establishments by the use of ore handling machinery and mechanical charging devices, which render unnecessary the presence of operatives at the top of the stack.

The economy in manual labor effected through the introduction of each of these improved methods and

devices has been confined to that class of wage-earners receiving the lower rates of pay, so that the direct tendency has been to raise the average earnings of the wage-earners who are employed.

The adoption, however, of these and other improvements has not as yet become universal, so that a large percentage of the plants, and especially the smaller and the older ones, still employ the methods that require the services of a relatively large proportion of the wage-earners who receive the lower rates of pay.

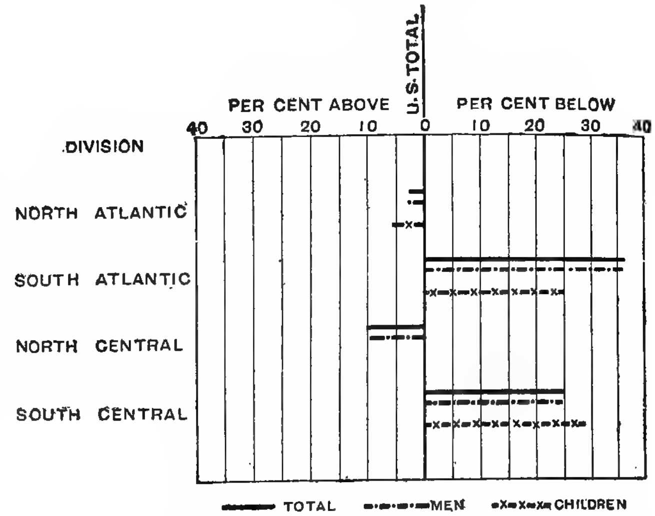
The presence of these modifying and mutually counteracting influences, which are peculiar to the pig iron industry, should therefore be kept in mind when comparisons between the various states and geographic groups are made.

The wage-earners employed in blast furnaces were almost exclusively men. In the selected establishments there were only 42 children and 1 woman among the 23,839 wage-earners employed during the specified week. It may be assumed, therefore, that the services performed by women and children were incidental and relatively of so little importance as to warrant their elimination from a consideration of average weekly earnings in the industry.

While the greatest number, 31 per cent, of the men employed in the blast furnaces of the United States received $10 to $12 for the representative week, 72.7 per cent, or nearly three-fourths of the total number, earned at least $10 for the week. More than two-fifths, therefore, received earnings of $12 per week or over, and the relatively large percentages at the higher rates of pay are reflected in the average weekly earnings, namely, $11.71, an amount only slightly less than the maximum limit of the group in which the greatest concentration occurs. Naturally the percentages at the lower amounts are small, and it is worthy of note in this connection that only about one-sixth of all the men employed in the industry received earnings of less than $9 per week.

The variations in the percentage distribution of men in Table 71 for certain of the geographic divisions as compared with that for the country as a whole, were slight, while in others they were pronounced. For example, the maximum concentration in the North Atlantic division was in the same group as that in which it occurred for the United States, while for the North Central division it was in the group next above, and in both the South Atlantic and the South Central divisions in the third group below. The fact that the weekly earnings in the United States closely approximate those for the North Atlantic and the North Central divisions results from the large proportion of men contributed by these divisions.

DIAGRAM 6.—*Classified weekly earnings, iron and steel, blast furnaces—per cent that average earnings of all wage-earners, and of men, women, and children are above or below the average for the United States, by geographic divisions: 1905.*



In the North Atlantic and the North Central divisions the average weekly earnings were substantially larger than those in the South Atlantic and the South Central divisions, and the concentration of men in the group within which the average earnings fell was more pronounced. For the North Atlantic division the greatest percentage of men in any wage group represents nearly one-third of the total number of men employed in the division, and for the North Central division it slightly exceeds this proportion; while for the South Atlantic division it covers but a little more than one-fourth, and for the South Central division less than one-fifth. The greater uniformity of the distribution of men among several groups of weekly earnings, and especially the relatively heavy proportions in the groups below that in which the maximum concentration occurs, which characterize the South Atlantic and the South Central divisions, are noteworthy. This condition indicates either that for a large majority of the men employed the range in the rates of wages was far more limited in the North Atlantic and the North Central divisions than in the South Atlantic and the South Central divisions, or that the wage-earners in the former divisions worked with greater steadiness and regularity, so that their actual weekly earnings more nearly approximated their weekly rates of wages. In view of the fact that negro labor was employed to a large extent in the South Atlantic and the South Central divisions, it is probable that the proportion of the fractional time put in by the average wage-earner was relatively much larger in these divisions than in the other divisions. This would result directly not only in reducing the average earnings but also in rendering

the per cent distribution of men by classified earnings less indicative of the range in rates of wages.

Aside from the fact that the level of wage rates in the South Atlantic and the South Central divisions is substantially lower than that in the other divisions in practically all branches of manufacture, another factor that accounts measurably for the large difference in the average weekly earnings of men employed in the blast furnaces of the two sections lies in the more extensive introduction, in the North Atlantic and the North Central divisions as a whole, of labor saving appliances. Of the total pig iron production of the South Atlantic group of states at the census of 1905, 47 per cent was sand cast, and in the South Central division practically the entire output was handled in this manner. Of the total production of the North Atlantic division, 30 per cent was cast by machinery and 43 per cent was delivered in a molten condition to associated steel works or rolling mills, the process of casting being eliminated entirely for this proportion of the product. For the North Central division the corresponding percentages were 25 and 34. As previously pointed out, it is the relatively low-priced labor that is displaced through the introduction of these methods, and the direct result is to raise the average earnings per employee in the industry.

The showing for Michigan, in the North Central division, is worthy of note. The concentration of 38.4 per cent of men in one group of earnings indicates exceptional uniformity in the weekly rates of wages among the several establishments in the state. The position of Michigan in the pig iron industry of the country is unique. Its product at the census of 1905 consisted almost entirely of charcoal pig iron, and the furnaces of the state contributed nearly 60 per cent of the total product of this kind of iron in the United States. The marked localization of this branch of pig iron manufacture in the state, resulting in the use of practically identical methods in the several plants, naturally conduces to uniformity in rates of wages as well as in weekly earnings.

The difference between the average weekly earnings of men in Alabama and Tennessee shown in Table 71 is striking, because it occurs in adjoining states of the same geographic division. The average for men in Alabama is nearly one-third greater than the corresponding average for Tennessee, although the median group of earnings is only one group higher. But the proportion of wage-earners shown, of the total of the industry in these states, is less than one-fourth.

Pennsylvania and Ohio, the two states leading in the manufacture of pig iron, had a combined output valued at 64 per cent of the total value of such products at the census of 1905. Nearly two-thirds of all wage-earners employed in the selected establishments were reported for these states. The largest number of men in Pennsylvania received as weekly earnings from $10 to $12, while in Ohio the greatest number received from $12 to $15. Of the total number of men in Pennsylvania, 76.5 per cent received weekly earnings of $10 or over, while in Ohio the proportion earning equal amounts was 86.5 per cent. The proportion of men earning less than $7 per week was small in both states, namely, 3.4 per cent in Pennsylvania and 3.8 per cent in Ohio; these low earnings were probably due more to fractional service than to weekly wage rates approximating the earnings represented by these groups. Notable differences in the per cent distribution of men in the two states, however, occur in the proportions of those earning from $7 to $10. More than one-fifth, 20.1 per cent, of the total number employed in Pennsylvania received such amounts, while the earnings of less than one-tenth, 9.7 per cent, of the total number in Ohio fell within these limits. The wider range in weekly amounts of earnings in Pennsylvania, which results in the average weekly earnings per man being lower than those in Ohio, aside from numerous local variations in conditions which affect the averages not only for different states but also for different sections of the same state, is due chiefly to the larger proportion of small plants in the former state. This fact does not appear from the statistics presented, which indicate, on the contrary, larger plants for Pennsylvania, the average number of men employed per establishment being 362 in that state while in Ohio it was only 293. This showing results, however, from a preponderance of very large establishments in the former state. The 29 selected plants in Pennsylvania and the 17 in Ohio are typical, not only with respect to wage conditions but also with respect to size, of all the establishments in the two states; and an examination of the returns for these plants discloses a much wider range in point of size among the plants of Pennsylvania than among those of Ohio. For example, 69 per cent of the selected establishments in Pennsylvania employed less than 300 men, the proportion in Ohio was 64 per cent, while the number employing less than 100 men was three times as great in the former state as in the latter. On the other hand there were 3 establishments in Pennsylvania in which the number of men employed ranged between 700 and 2,200, while in Ohio there was only 1 establishment of similar size.

The level of weekly earnings throughout the iron district comprising western Pennsylvania and eastern Ohio, shows little variation among the individual plants that were similarly equipped and in which the length of the working day and other conditions were substantially the same. Furthermore, while it is true that the average weekly earnings were generally lower in the numerous small plants in Pennsylvania outside of the Pittsburg district, the converse proposition, namely, that the highest wages were paid in the very largest plants in the state, does not hold, there

being little variation in the average weekly earnings of the men employed in plants of medium or average size and those engaged in the largest establishments. Hence, while the preponderance of small plants in Pennsylvania tends to reduce the average weekly earnings in the state below the average in Ohio, no corresponding and counteracting influence arises from the similar preponderance of large plants in the state to raise it, and the slightly lower average weekly earnings in Pennsylvania follow.

TOBACCO, CIGARS AND CIGARETTES.

Of the 16,395 establishments, shown in Table 18, reported at the census of 1905 as engaged in this industry, 4,268 had no wage-earners. The number of establishments from which statements of earnings might be secured was therefore 12,127, and statistics for 74.5 per cent of these establishments are included in the report on classified weekly earnings. The wage-earners employed in the selected establishments during the specified week formed more than one-half of the greatest number employed in all establishments at any one time during the year and 62.2 per cent of the average number employed during the year. The industry is most widely distributed, and the data presented represent wage-earners in every state and territory.

The greatest proportion of wage-earners included in the statistics of classified earnings is shown for the South Central division, and the smallest proportion for the Western division. Among the states prominent in the industry the highest proportion, over nine-tenths, is for Massachusetts. Several states are represented by two-thirds or three-fourths and others by one-half of the greatest number employed.

Cumulative percentages for the United States show the earnings of the median group to have been $10 to $12 for men; $5 to $6 for women; and less than $3 for children.

A remarkable showing is that the average weekly earnings for men and children were higher in the South Atlantic division than in the North Atlantic. This was doubtless due in part to the high averages for hand work in Florida and to the large earnings in West Virginia. The Western division, however, showed the highest earnings of all.

In the manufacture of cigarettes machinery is used, and the processes are in the main accomplished by the agency of women and children. The earnings in many of the states are largely influenced by the manufacture of these products.

Generally states where machinery was used can be identified by the preponderance of women among the wage-earners; in the state of New York, however, the women, although constituting a large proportion, were not in the majority.

TABLE 18.—*Tobacco, cigars and cigarettes—all establishments and greatest number of wage-earners, compared with number of establishments and wage-earners, selected for classified earnings, by states, territories, and geographic divisions: 1905.*

STATE OR TERRITORY.	ESTABLISHMENTS.		WAGE-EARNERS.		
	Total number.	Number selected for classified earnings.	Greatest number employed at any one time during the year, all establishments.	Number in specified week, selected establishments.	
				Total.	Per cent of greatest number in all establishments.
United States	16,395	9,033	163,982	84,292	51.4
North Atlantic division	7,537	4,014	87,731	43,860	50.0
Maine	64	35	319	165	51.7
New Hampshire	45	29	396	77	19.4
Vermont	23	16	94	52	55.3
Massachusetts	348	250	4,190	3,886	92.7
Rhode Island	38	24	248	194	78.2
Connecticut	226	137	1,402	623	44.4
New York	3,475	1,709	38,102	18,369	48.2
New Jersey	544	276	7,062	4,695	66.5
Pennsylvania	2,774	1,538	35,918	15,799	44.0
South Atlantic division	826	461	25,966	13,088	50.4
Delaware	19	14	263	235	89.4
Maryland	340	207	3,630	1,709	47.1
District of Columbia	25	11	84	48	57.1
Virginia	95	53	5,224	2,510	48.0
West Virginia	79	48	1,311	803	61.3
North Carolina	16	8	1,100	981	89.2
South Carolina	7	6	515	223	43.3
Georgia	37	23	352	314	89.2
Florida	208	91	13,487	6,265	46.5
North Central division	6,824	3,868	42,116	22,717	53.9
Ohio	1,311	732	12,755	6,714	52.6
Indiana	536	317	3,125	1,861	59.6
Illinois	1,788	1,001	8,292	4,790	57.8
Michigan	696	394	6,639	2,933	44.2
Wisconsin	757	418	2,970	1,686	56.8
Minnesota	349	210	2,145	1,047	48.8
Iowa	440	258	2,588	1,167	45.1
Missouri	544	306	2,024	1,455	71.9
North Dakota	27	13	44	26	59.1
South Dakota	47	28	205	103	50.2
Nebraska	157	82	616	349	56.7
Kansas	172	109	713	586	82.2
South Central division	432	244	4,338	2,782	64.1
Kentucky	184	102	1,545	911	59.0
Tennessee	40	23	291	119	40.9
Alabama	32	22	211	136	64.5
Louisiana	[1] 26	[2] 11	1,687	1,236	73.3
Arkansas	20	16	67	65	97.0
Indian Territory	8	3	12	10	83.3
Oklahoma	39	18	85	46	54.1
Texas	83	40	440	259	58.9
Western division	[3] 776	[3] 446	3,831	1,845	48.2
Montana	44	32	122	112	91.8
Wyoming	12	7	34	23	67.6
Colorado	117	61	566	398	70.3
New Mexico	7	4	29	13	44.8
Arizona	11	7	90	70	77.8
Utah	27	16	190	52	27.4
Nevada	5	5	23	23	100.0
Idaho	17	12	61	52	85.2
Washington	[3] 103	[3] 65	326	189	58.0
Oregon	54	24	191	67	35.1
California	379	213	2,199	846	38.5

[1] Includes Mississippi, 4. [2] Includes Mississippi, 1. [3] Includes Alaska, 1.

In a comparison of earnings by states account must be taken of the well-known fact that wages of all kinds are usually greater in certain sections of the country, as in the Western states, because of a higher cost of living, different social and trade conditions, etc.

The variation in the proportions of wage-earners earning like amounts in the various states and terri-

tories is due, therefore, to the absence or presence of machinery, to the difference in the hours of labor, to the variation in the grades and styles of cigars and cigarettes manufactured, to the basis of payment—whether by the hour, week, or piece—and to social, commercial, and trades union conditions and restrictions.

TABLE 19.—*Tobacco, cigars and cigarettes—per cent distribution of wage-earners—men, women, and children—by geographic divisions: 1905.*

DIVISION.	NUMBER.			EARNINGS.		
	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.
United States	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic	46.9	60.5	36.2	44.8	62.6	33.0
South Atlantic	16.7	13.6	19.2	17.9	12.2	22.1
North Central	30.9	21.0	33.8	31.1	21.1	32.6
South Central	2.2	4.3	8.8	2.0	3.4	9.7
Western	3.3	0.6	2.0	4.2	0.7	2.6

The greatest proportion of each class of wage-earners engaged in the production of cigars and cigarettes in the selected establishments was reported for the North Atlantic division. Nearly one-half of the men, almost two-thirds of the women, and over one-third of the children were employed in the states of this division. The North Central division was second in its proportions of the totals. The Western was last in the numbers of women and children and the South Central last in the number of men.

The North Atlantic division was predominant so far as influence upon the statistics for the United States is concerned, the North Central ranking next. New York, Pennsylvania, and New Jersey were the leading states in the North Atlantic division, and Ohio, Illinois, Michigan, and Indiana in the North Central.

TABLE 20.—*Tobacco, cigars and cigarettes—per cent distribution by class, of number and earnings of wage-earners in each geographic division: 1905.*

DIVISION.	NUMBER.			EARNINGS.		
	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.
United States	55.4	40.8	3.8	70.8	27.9	1.3
North Atlantic	49.9	47.4	2.7	63.9	35.2	0.9
South Atlantic	59.6	35.6	4.8	77.4	20.8	1.8
North Central	63.4	31.8	4.8	77.7	20.8	1.5
South Central	36.9	52.9	10.2	57.3	37.6	5.1
Western	84.4	12.1	3.5	92.5	6.4	1.1

The industry gives employment to a large number of women. Of the total number of wage-earners engaged in the production of cigars and cigarettes in the United States, only slightly more than one-half were men, over 40 per cent were women, and nearly 4 per cent were children. This proportion of women wage-earners is double that of the total for factories of all kinds in the United States. The Western division had the greatest proportion of men and the smallest proportion of women; the South Central, the smallest proportion of men and the greatest proportion of women and children. Most of the states for which a large proportion of women is shown are on the Atlantic seaboard, although Ohio and Michigan are quite prominent in this respect.

At the census of 1880 the average number of women returned was 22.7 per cent of the number of men; in 1890 it had increased to 40.7 per cent; in 1900, to 60.8 per cent; and in 1905, to 78.4 per cent. The increasing employment of women as wage-earners in this industry is due to the rapid extension of the use of machinery. The extent to which the employment of women has increased renders of interest a statistical presentation of the states in which they are in excess of men.

TABLE 21.—TOBACCO, CIGARS AND CIGARETTES—NUMBER AND EARNINGS OF MEN AND WOMEN EMPLOYED AS WAGE-EARNERS, IN SELECTED ESTABLISHMENTS, FOR STATES IN WHICH WOMEN ARE IN EXCESS OF MEN: 1905.

STATE.	NUMBER.					EARNINGS.				
	All wage-earners.	Men 16 years and over.	Women 16 years and over.			All wage-earners.	Men 16 years and over.	Women 16 years and over.		
			Total.	Per cent of total number of wage-earners.	Per cent in excess of number of men.			Amount.	Per cent of earnings of all wage-earners.	Per cent less or greater than earnings of men.
Total	33,618	13,311	18,393	54.7	38.2	$219,656	$119,082	$94,869	43.2	20.3—
Delaware	235	91	139	59.1	52.7	1,818	876	931	51.2	6.3+
Georgia	314	112	180	57.3	60.7	2,062	1,210	791	38.4	34.6—
Kentucky	911	323	493	54.1	52.6	5,731	3,039	2,420	42.2	20.4—
Louisiana and Mississippi	1,236	193	911	73.7	372.0	6,141	1,518	4,116	67.0	171.1+
New Jersey	4,695	1,414	3,025	64.4	113.9	30,673	13,730	16,267	53.0	18.5+
North and South Carolina	1,204	304	670	55.6	120.4	5,271	1,818	2,719	51.6	49.6+
Ohio	6,714	2,778	3,723	55.5	34.0	50,997	28,462	21,922	43.0	23.0—
Pennsylyania	15,799	7,370	7,745	49.0	5.1	104,316	63,436	39,142	37.5	38.3—
Virginia	2,510	726	1,507	60.0	107.6	12,647	4,993	6,561	51.9	31.4+

The statistics for classified weekly earnings give 11 states with more women than men employed during the week for which earnings were returned; of these states, 7 are shown in the general statistics as having a greater average number of women employed during the year. In 2 of the remaining states shown in Table 21, the average number of women employed during the year was nearly that of men. Pennsylvania had an average of 14,336 women and 14,387 men, and Delaware, 50 women and 56 men. The numbers for the two sexes are so nearly the same that it is not strange that the establishments selected for statistics of earnings happen to include more women than men. Kentucky, which is included among the states with an excess of women, had, according to the general report, an average of 491 women and 645 men. Michigan, however, which had 332 more women than men in the average number as shown in the general report, is not among the states having an excess as shown in the special report.

The excess of women over men among the wage-earners in the states shown in Table 21 ranged from 5.1 per cent in Pennsylvania to 372 per cent in Louisiana and Mississippi. The total excess was 38.2 per cent, but the earnings of the women were 20.3 per cent less than the earnings of men.

The states in which the percentage of difference in earnings was least marked are Delaware, New Jersey, Kentucky, and Ohio. The states in which the greatest disproportion occurred are Louisiana and Mississippi, North and South Carolina, Pennsylvania, Georgia, and Virginia.

TABLE 22.—*Tobacco, cigars and cigarettes—earnings of men and women in states grouped according to the proportion of women to men: 1905.*

[Only establishments in which 10 women or more were employed as wage-earners are included.]

	Number of states and territories.	MEN 16 YEARS AND OVER.		WOMEN 16 YEARS AND OVER.	
		Median group of earnings.	Average weekly earnings.	Median group of earnings.	Average weekly earnings.
Total	[1] 31	$10 to $12	$11.09	$5 to $6	$5.97
Women in excess of men	10	9 to 10	8.95	4 to 5	5.16
Women at least 40 per cent of men	6	10 to 12	10.70	6 to 7	6.98
Women less than 40 per cent of men	15	12 to 15	12.99	6 to 7	6.73

[1] Fifteen states and territories had less than 10 women wage-earners; 4 reported none.

It is evident that the earnings of both men and women were lowest in states where more women than men were employed. The largest earnings for men were in establishments where the number of women was less than 40 per cent of the number of men.

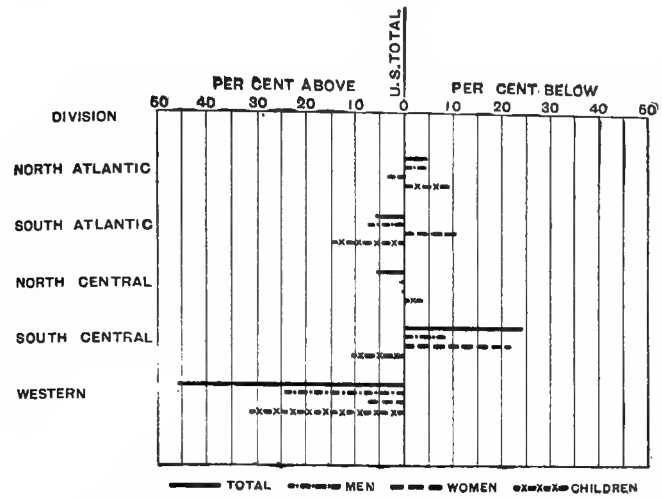
Whether the employment of women in cigar and cigarette factories lessens the earnings of men may be too intricate a problem to be completely solved by an analysis of general figures, but such an analysis is of some value. The large numbers for New York have great effect on the totals for the group of establishments in which women were less than 40 per cent of the men, for in this state the women numbered 93.1 per cent of the men.

TABLE 23.—*Tobacco, cigars and cigarettes—median groups and average earnings of wage-earners—men, women, and children—in states in which women are in excess of men: 1905.*

STATE.	MEN 16 YEARS AND OVER.		WOMEN 16 YEARS AND OVER.		CHILDREN UNDER 16 YEARS.	
	Median group of earnings.	Average weekly earnings.	Median group of earnings.	Average weekly earnings.	Median group of earnings.	Average weekly earnings.
Delaware	$9 to $10	$9.63	$6 to $7	$6.70	Less than $3	$2.20
Georgia	10 to 12	10.80	4 to 5	4.39	Less than $3	2.77
Kentucky	9 to 10	9.41	4 to 5	4.91	Less than $3	2.86
Louisiana and Mississippi	7 to 8	7.87	4 to 5	4.52	$3 to $4	3.84
New Jersey	9 to 10	9.71	4 to 5	5.38	Less than $3	2.64
North and South Carolina	5 to 6	5.98	4 to 5	4.06	$3 to $4	3.19
Ohio	10 to 12	10.25	5 to 6	5.89	$3 to $4	2.88
Pennsylvania	8 to 9	8.61	4 to 5	5.05	Less than $3	2.54
Virginia	5 to 6	6.88	4 to 5	4.35	$3 to $4	3.95

Of the individual states having more women than men among the wage-earners, Georgia is shown with the greatest average earnings for men, and Ohio, with the next greatest, while the largest proportion of men in the higher groups of earnings was for Ohio. The men of North and South Carolina earned the least, as shown both by the average earnings and by the distribution of earnings by groups. Of the women, those in Delaware earned the most, and those in Ohio were second in rank, although their average earnings for the week were less by 81 cents. North and South Carolina showed the least earnings for women and Georgia the greatest proportion of women wage-earners at the lowest amount. (See Table 71.) The average earnings of children were greatest in Virginia, although the average for Louisiana and Mississippi was almost as large. The least average weekly earnings are shown for Delaware, each of the 5 children in that state being paid less than $3.

DIAGRAM 7.—*Classified weekly earnings, tobacco, cigars and cigarettes—per cent that average earnings of all wage-earners, and of men, women, and children are above or below average for the United States, by geographic divisions: 1905.*



Since 1880 there has been a decrease in the average number of children employed in the production of cigars and cigarettes. In that year the children formed 7.7 per cent of all wage-earners; at the census of 1890 the percentage was 3.8, while at the census of 1900 it was 3.4, and at the census of 1905, 3.9. While the decrease in proportion since 1880 is large, there was a slight retrogression at the census of 1905.

The greatest absolute number of children employed in the selected establishments is shown for the North Atlantic division; but the greatest proportion of children among all wage-earners in the industry was reported for the South Central division, the percentage being 10.2, which is more than double that of any other division. This percentage was due to the conditions in the states of Kentucky and Louisiana. Of the more prominent states, North and South Carolina had the greatest proportion, 19.1 per cent; Virginia was second with 11 per cent. The percentage for Louisiana was 10.7 and that for Kentucky 10.4.

The Western division had the smallest number of children, although relatively the number was greater than that for the North Atlantic division. Among the leading states with relatively few children were New York, with 1 per cent; New Jersey, with 5.5 per cent; and Pennsylvania, with 4.3 per cent.

STATES, TERRITORIES, AND GEOGRAPHIC DIVISIONS.

Classified weekly earnings.—Table 24 gives the proportion of wage-earners included in the statistics, together with the median group of earnings and the average weekly earnings for all wage-earners and for men, women, and children, by states, territories, and geographic divisions.

The ranking of states and territories by average earnings has the defect of giving undue weight to the numbers reported in the extreme groups of earnings, as "the average disregards the significance of the parts and aims to give expression to the whole in a single term."[1] Another method of ranking is by median groups; and, when, as frequently happens, several states or territories have the same median, by the greatest percentage above 50 accumulated within such group. This method shows rank according to earnings of at least one-half of the wage-earners. "It is far more important to know that one-half of the laboring class receive wages between $1.25 and $1.75 per day, than to know that the average of the total is $1.50."[1]

Two other methods might be utilized: (1) Calculation of the median so that an assumption could be made that it was at a definite point within the group; or (2) accumulation of the percentage of wage-earners nearest 50 per cent.

Both of these methods are unsatisfactory. According to the first the rather doubtful assumption must be made that the wage-earners are distributed uniformly throughout the group; the second has some of the disadvantages inherent in a showing by median groups. An example of the calculation of the median is as follows: Of the total number of men employed in the United States, 37.9 per cent received $12 or more, and 53.5 per cent received $10 or more; hence, in order to accumulate 50 per cent, to the 37.9 per cent receiving $12 or more must be added 12.1 per cent out of the 15.6 per cent included in the median group of $10 to $12; the remaining 3.5 per cent, forming a little over one-fifth (22.4 per cent) of the total in the group, falls below the median, which is therefore equal to $10 (the minimum for the group) plus 22.4 per cent of $2 (the amount covered by the group), or $10.45. It is very doubtful whether the result obtainable by this method would justify the labor involved in the computation.

[1] Twelfth Census, Employees and Wages, page XXV.

TABLE 24.—MEDIAN GROUPS AND AVERAGE WEEKLY EARNINGS, ALL WAGE-EARNERS AND MEN, WOMEN, AND CHILDREN, BY STATES, TERRITORIES, AND GEOGRAPHIC DIVISIONS: 1905.

[At least one-half of all the wage-earners, or of men, women, or children, received earnings as great as, or greater than, the lowest earnings of the median group.]

STATE OR TERRITORY.	Per cent which number of all wage-earners included in statistics of weekly earnings forms of greatest number, all establishments.	MEDIAN GROUPS AND AVERAGE WEEKLY EARNINGS.							
		All wage-earners.		Men 16 years and over.		Women 16 years and over.		Children under 16 years.	
		Median group of earnings.	Average weekly earnings.	Median group of earnings.	Average weekly earnings.	Median group of earnings.	Average weekly earnings.	Median group of earnings.	Average weekly earnings.
United States	47.0	$9 to $10	$10.06	$10 to $12	$11.16	$6 to $7	$6.17	$3 to $4	$3.46
North Atlantic division	50.0	9 to 10	10.11	10 to 12	11.41	6 to 7	6.56	3 to 4	3.81
New England	66.3	9 to 10	9.67	10 to 12	11.03	6 to 7	6.87	4 to 5	4.10
Maine	38.6	9 to 10	9.39	9 to 10	10.23	6 to 7	6.84	4 to 5	4.20
New Hampshire	37.8	8 to 9	9.04	9 to 10	10.03	6 to 7	6.99	4 to 5	4.04
Vermont	47.1	9 to 10	9.24	9 to 10	9.89	6 to 7	6.19	3 to 4	3.45
Massachusetts	84.2	9 to 10	9.68	10 to 12	11.15	6 to 7	6.91	4 to 5	4.20
Rhode Island	61.5	8 to 9	9.19	10 to 12	10.73	6 to 7	6.66	3 to 4	3.65
Connecticut	48.7	9 to 10	10.34	10 to 12	11.57	6 to 7	6.81	4 to 5	4.14
Southern North Atlantic	42.1	9 to 10	10.45	10 to 12	11.67	5 to 6	6.23	3 to 4	3.51
New York	40.0	9 to 10	10.40	10 to 12	11.79	6 to 7	6.54	3 to 4	3.64
New Jersey	43.5	9 to 10	10.41	10 to 12	11.75	5 to 6	6.03	3 to 4	3.55
Pennsylvania	43.9	9 to 10	10.51	10 to 12	11.53	5 to 6	5.68	3 to 4	3.46
South Atlantic division	41.1	6 to 7	7.31	7 to 8	8.39	4 to 5	4.42	Less than $3	2.74
Northern South Atlantic	42.5	8 to 9	8.90	9 to 10	10.02	4 to 5	4.82	Less than $3	3.05
Delaware	53.7	8 to 9	9.27	9 to 10	10.00	5 to 6	5.13	$3 to $4	3.67
Maryland	47.4	7 to 8	8.60	9 to 10	10.27	4 to 5	4.99	Less than $3	2.87
District of Columbia	60.4	10 to 12	11.16	10 to 12	11.87	5 to 6	5.12	$3 to $4	3.56
Virginia	30.4	6 to 7	7.69	7 to 8	8.47	3 to 4	3.95	3 to 4	3.05
West Virginia	46.0	9 to 10	10.52	9 to 10	11.00	4 to 5	5.12	3 to 4	3.67
Southern South Atlantic	39.8	5 to 6	5.69	5 to 6	6.57	3 to 4	3.99	Less than $3	2.65
North Carolina	45.7	4 to 5	4.96	5 to 6	5.92	3 to 4	3.60	Less than $3	2.58
South Carolina	42.7	4 to 5	4.68	5 to 6	5.47	3 to 4	3.84	Less than $3	2.79
Georgia	38.7	5 to 6	6.10	6 to 7	6.70	4 to 5	4.24	Less than $3	2.59
Florida	26.9	7 to 8	9.04	7 to 8	9.37	5 to 6	6.55	Less than $3	2.66
North Central division	48.1	10 to 12	10.62	10 to 12	11.44	5 to 6	5.64	$3 to $4	3.62
Eastern North Central	49.4	9 to 10	10.66	10 to 12	11.47	5 to 6	5.60	3 to 4	3.62
Ohio	53.8	9 to 10	10.63	10 to 12	11.49	5 to 6	5.43	3 to 4	3.61
Indiana	60.7	9 to 10	10.10	9 to 10	10.88	4 to 5	4.83	3 to 4	3.75
Illinois	47.0	10 to 12	11.55	10 to 12	12.37	6 to 7	6.54	3 to 4	3.58
Michigan	49.8	9 to 10	9.92	10 to 12	10.78	5 to 6	5.17	3 to 4	3.66
Wisconsin	33.6	9 to 10	10.12	10 to 12	10.75	5 to 6	5.12	3 to 4	3.51
Western North Central	43.0	10 to 12	10.47	10 to 12	11.32	5 to 6	5.79	3 to 4	3.61
Minnesota	33.2	10 to 12	11.01	10 to 12	11.75	6 to 7	6.27	3 to 4	3.39
Iowa	42.8	9 to 10	9.67	10 to 12	10.48	4 to 5	4.95	3 to 4	3.44
Missouri	43.5	9 to 10	10.39	10 to 12	11.38	6 to 7	6.02	3 to 4	3.55
North Dakota	39.0	12 to 15	11.81	12 to 15	12.74	6 to 7	6.77	3 to 4	3.00
South Dakota	50.5	10 to 12	11.69	12 to 15	12.26	6 to 7	6.82	4 to 5	3.77
Nebraska	61.3	10 to 12	10.89	10 to 12	11.66	5 to 6	5.60	4 to 5	4.20
Kansas	51.4	10 to 12	10.58	10 to 12	11.22	4 to 5	5.01	3 to 4	3.70
South Central division	33.7	7 to 8	8.33	8 to 9	8.91	4 to 5	4.69	Less than $3	2.86
Eastern South Central	35.6	7 to 8	7.86	7 to 8	8.53	4 to 5	4.67	Less than $3	2.80
Kentucky	43.2	7 to 8	8.38	8 to 9	9.20	4 to 5	4.94	Less than $3	2.81
Tennessee	39.6	6 to 7	7.51	7 to 8	8.17	4 to 5	4.37	Less than $3	2.73
Alabama	31.4	6 to 7	7.65	7 to 8	8.30	4 to 5	4.46	Less than $3	2.85
Mississippi	23.8	7 to 8	7.79	7 to 8	8.15	4 to 5	4.79	Less than $3	2.78
Western South Central	31.0	8 to 9	9.07	9 to 10	9.46	4 to 5	4.73	$3 to $4	3.12
Louisiana	19.3	8 to 9	9.16	9 to 10	9.93	4 to 5	4.52	3 to 4	3.23
Arkansas	35.2	7 to 8	7.95	7 to 8	8.11	3 to 4	4.13	3 to 4	2.88
Indian Territory	56.1	9 to 10	10.82	10 to 12	11.11	5 to 6	5.33	3 to 4	3.49
Oklahoma	48.8	10 to 12	10.30	10 to 12	10.82	5 to 6	5.81	3 to 4	3.64
Texas	40.2	9 to 10	9.51	9 to 10	9.84	5 to 6	5.03	3 to 4	3.08
Western division	42.7	12 to 15	13.65	12 to 15	14.62	7 to 8	7.17	4 to 5	4.35
Rocky Mountain	43.1	12 to 15	14.96	15 to 20	15.48	7 to 8	7.33	4 to 5	5.56
Montana	40.9	15 to 20	18.19	15 to 20	18.60	7 to 8	8.60	7 to 8	7.09
Idaho	28.3	12 to 15	14.81	12 to 15	15.30	6 to 7	7.62	5 to 6	4.93
Wyoming	86.6	15 to 20	15.75	15 to 20	15.93	6 to 7	7.18	Less than $3	3.40
Colorado	42.5	12 to 15	14.14	12 to 15	14.78	6 to 7	7.14	$5 to $6	5.84
New Mexico	45.8	10 to 12	12.18	10 to 12	12.42	6 to 7	6.22	3 to 4	3.49
Basin and Plateau	34.3	12 to 15	14.71	15 to 20	15.46	5 to 6	5.65	3 to 4	3.87
Arizona	56.4	15 to 20	16.15	15 to 20	16.27	6 to 7	7.50	5 to 6	4.77
Utah	20.8	10 to 12	11.93	12 to 15	13.35	5 to 6	5.34	3 to 4	3.75
Nevada	57.8	15 to 20	17.76	15 to 20	18.05	8 to 9	8.29	6 to 7	4.50
Pacific	43.3	12 to 15	13.29	12 to 15	14.35	7 to 8	7.20	4 to 5	4.16
Washington	32.0	12 to 15	13.84	12 to 15	14.13	6 to 7	6.69	3 to 4	4.26
Oregon	37.6	12 to 15	12.58	12 to 15	13.21	6 to 7	7.02	4 to 5	4.54
California	49.2	12 to 15	13.24	12 to 15	14.59	7 to 8	7.24	4 to 5	4.12
Alaska	36.8	12 to 15	13.83	12 to 15	14.25	8 to 9	9.07	3 to 4	3.62

DIAGRAM 8.—*Classified weekly earnings—per cent distribution of number of men by groups of earnings in geographic divisions: 1905.*

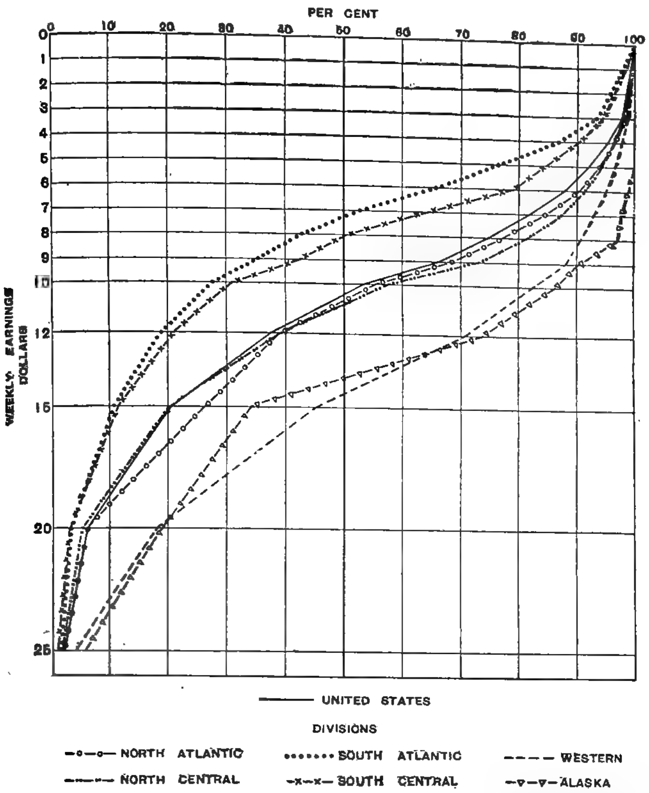
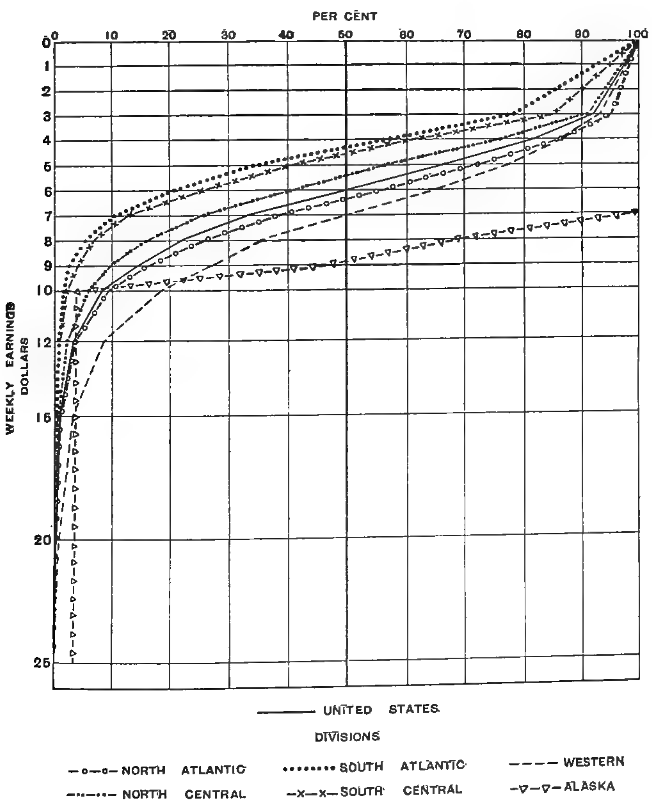


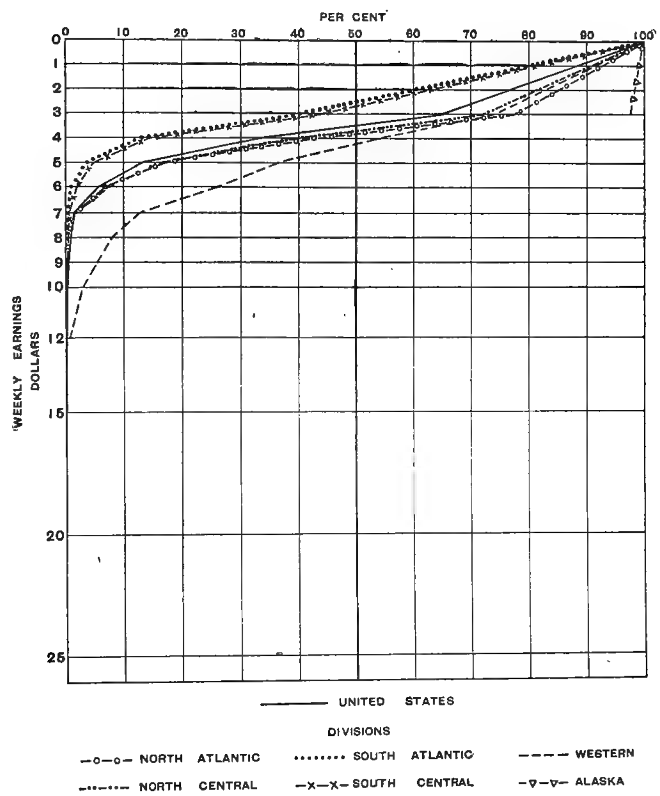
DIAGRAM 9.—*Classified weekly earnings—per cent distribution of number of women by groups of earnings in geographic divisions: 1905.*



The Western division, according to Table 24, shows the highest medians and averages for men, women, and children. The average for women as compared with the averages for men and children is relatively lower in this division than in the country as a whole.

The medians and averages for the two Northern divisions are very similar to those for the United States as a whole. In the North Atlantic division the medians for men, women, and children are identical with those for the country as a whole, while the averages are a little higher. In the North Central division the median and average for women are both lower than the corresponding figures for the United States; but the figures for men and children are high enough to more than offset this, so that the median and the average for all wage-earners in this division are higher than the corresponding figures for the North Atlantic division.

DIAGRAM 10.—*Classified weekly earnings—per cent distribution of number of children by groups of earnings in geographic divisions: 1905.*



The medians and averages for the two Southern divisions are lower than those for the United States. The South Atlantic shows the lowest averages of all the divisions. In the case of men the average for the South Atlantic is so much lower than that for the South Central as to bring the median for men, and even that for all wage-earners, into the next lower group.

The minor divisions follow, in general, the same order. But the advantage of the South Central division over the South Atlantic is found to be due to the fact that the averages for the Eastern South Central

are higher than those for the Southern South Atlantic; between the Northern South Atlantic and the Western South Central there is very little difference.

Rank by average weekly earnings.—The defects of averages have been frequently discussed,[1] but their use seems necessary to a ranking of the states and territories by earnings, as in Table 25, for all wage-earners and for men, women, and children, the states and territories being arranged in the order of their rank for all wage-earners. Several states have equal averages in Table 24, but when these are extended to another decimal point a difference between them is found, and this difference is observed in Table 25.

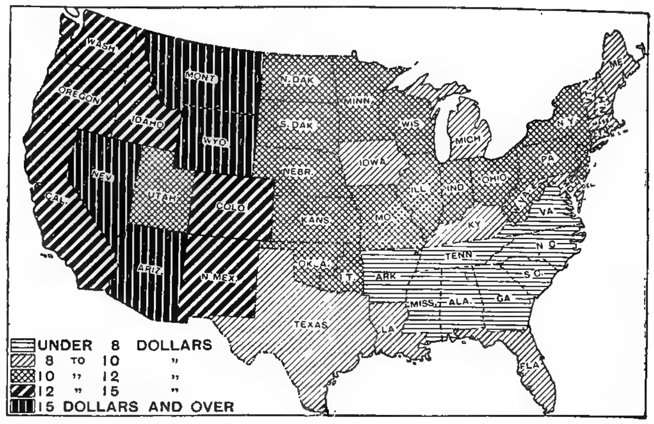
TABLE 25.—*Rank of geographic divisions, states, and territories with respect to average weekly earnings: 1905.*

GEOGRAPHIC DIVISION AND STATE OR TERRITORY.	RANK WITH RESPECT TO AVERAGE WEEKLY EARNINGS OF—			
	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.
Main divisions:				
Western	1	1	1	1
North Central	2	2	3	3
North Atlantic	3	3	2	2
South Central	4	4	4	4
South Atlantic	5	5	5	5
States and territories:				
Montana	1	1	2	1
Nevada	2	2	3	6
Arizona	3	3	5	4
Wyoming	4	4	7	36
Idaho	5	5	4	3
Colorado	6	6	8	2
Washington	7	9	16	7
Alaska	8	8	1	24
California	9	7	6	12
Oregon	10	11	9	5
New Mexico	11	13	22	31
Utah	12	10	30	16
North Dakota	13	12	15	41
South Dakota	14	15	13	14
Illinois	15	14	19	26
District of Columbia	16	16	36	27
Minnesota	17	19	21	37
Nebraska	18	20	28	9
Indian Territory	19	27	31	32
Ohio	20	23	29	25
Kansas	21	25	38	17
West Virginia	22	28	34	19
Pennsylvania	23	22	27	33
New Jersey	24	18	24	29
New York	25	17	20	22
Missouri	26	24	25	28
Connecticut	27	21	14	11
Oklahoma	28	30	26	23
Wisconsin	29	32	35	30
Indiana	30	29	42	15
Michigan	31	31	32	20
Massachusetts	32	26	11	8
Iowa	33	34	40	35
Texas	34	41	37	39
Maine	35	36	12	10
Delaware	36	38	33	18
Vermont	37	40	23	34
Rhode Island	38	33	17	21
Louisiana	39	39	44	38
Florida	40	42	18	49
New Hampshire	41	37	10	13
Maryland	42	35	39	43
Kentucky	43	43	41	45
Arkansas	44	48	48	42
Mississippi	45	47	43	47
Virginia	46	44	49	40
Alabama	47	45	45	44
Tennessee	48	46	46	48
Georgia	49	49	47	50
North Carolina	50	50	51	51
South Carolina	51	51	50	46

One of the most striking things revealed by Table 25 is the fact that, with respect to the averages for all wage-earners, the 11 Western states form a series, broken only by Alaska, from Montana to Utah. The Western states are followed by the North Central states from North Dakota to Kansas, together with the District of Columbia and Indian Territory. Then comes West Virginia, highest in rank among the South Atlantic states, followed by the Southern North Atlantic group.

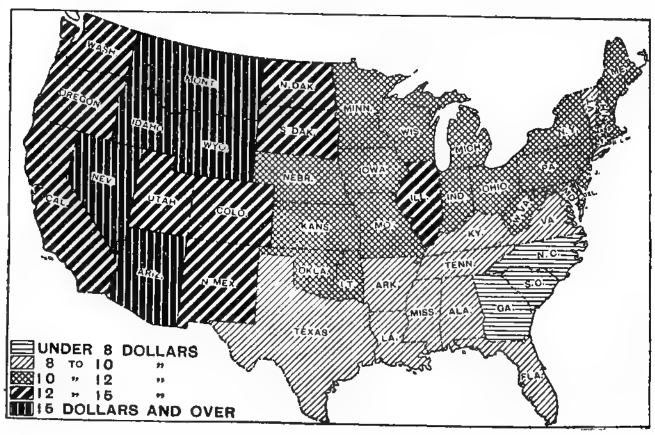
[1] Twelfth Census, Employees and Wages, pages xxiv and xxv. Census of Manufactures, 1905, Part I, pages lxxxix to xciv.

MAP 1.—*Average weekly earnings—all wage-earners, by states and territories: 1905.*



Below these are the rest of the North Central states, with the New England states of Connecticut and Massachusetts, and Oklahoma of the South Central division. Next in rank is Texas, the highest among the South Central states. Then come the remaining New England states, alternating with Delaware and Florida of the South Atlantic group and Louisiana of the South Central. Following these are the rest of the Southern states, North Carolina and South Carolina being the lowest in rank.

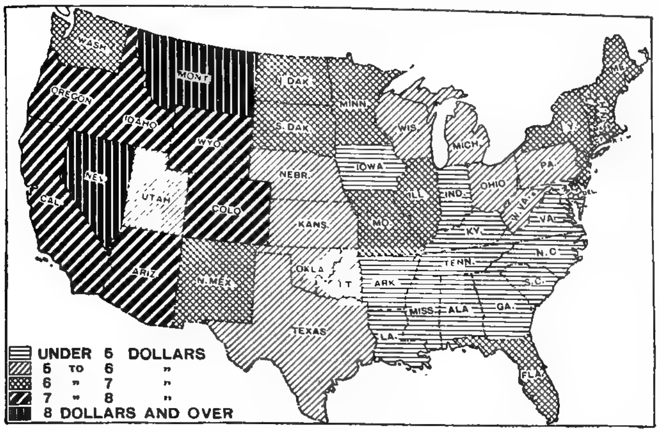
MAP 2.—*Average weekly earnings—men 16 years and over, by states and territories: 1905.*



The ranking of men is very similar to that for all wage-earners, the most conspicuous differences being that North Dakota interrupts the series of Western states, outranking New Mexico; and that the three Southern North Atlantic states, together with the adjoining New England states of Massachusetts, Rhode Island, and Connecticut, show an advance in rank,

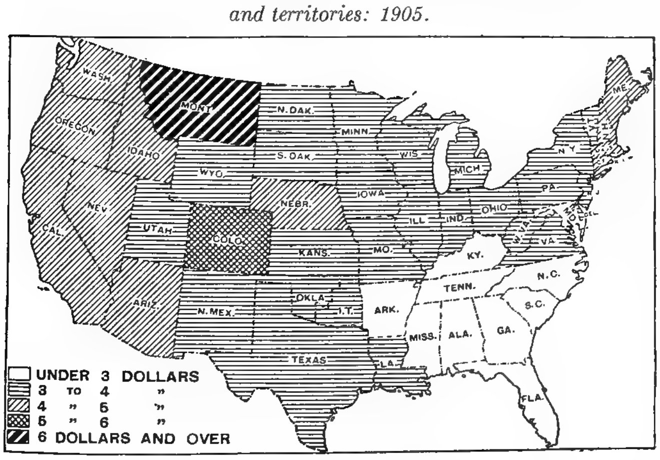
while the Southern states of West Virginia and Texas show a decline.

MAP 3.—*Average weekly earnings—women 16 years and over, by states and territories: 1905.*



The ranking of women and children differs to a marked degree from that for men. In the average earnings of women, Alaska outranks all other states and territories. The comparatively few women reported for the territory were employed almost exclusively in the canning and preserving of fish. Next come the Western states, with the exception of Washington, New Mexico, and Utah. Then follow the New England states, except Vermont, together with Washington, North Dakota, and South Dakota. Next comes Florida, by far the highest Southern state, followed by New Mexico and Utah in the West, Vermont in New England, the Southern North Atlantic states, and one-half of the North Central states. Next come the Northern South Atlantic states other than Virginia, with the remaining North Central states, and Texas and Kentucky of the South Central. Last of all are the remaining Southern states.

MAP 4.—*Average weekly earnings—children under 16 years, by states and territories: 1905.*



In the average earnings of children the Western states, excepting California, Utah, New Mexico, and Wyoming, outrank the foremost of the New England states, but the average for Massachusetts is just below that for Washington. The averages for Maine and Connecticut are higher than the average for California. Alaska, New Mexico, and Wyoming are found, in the order named, among those Northern states which are low in rank. Of the Northern South Atlantic states Delaware and West Virginia follow California and Utah, but outrank all of the Southern North Atlantic states. The rank of Florida for children, unlike that for women, is very low.

When the rank of each state with respect to all wage-earners is compared with its rank as to men, women, and children, it is found that among the Western states the average for women is relatively low in New Mexico, Utah, and Washington; while that for children is low in Wyoming and New Mexico, and high in Colorado and Oregon. In the North Atlantic states the average for women is high throughout New England, and in the North Central it is low in Kansas. The average for children is relatively high in all New England states, also in Indiana, Michigan, and Nebraska among the North Central states; and low in New Jersey and Pennsylvania of the North Atlantic and in Minnesota and North Dakota of the North Central. In the South Atlantic and South Central divisions, exclusive of the District of Columbia, Indian Territory, and Oklahoma, the only wide variations are the high average for women in Florida, the low average for women in West Virginia, and the high averages for children in Delaware and West Virginia; attention has already been called to the fact that with respect to the average for all wage-earners these 3 states rank among the highest of the South Atlantic division. The average weekly earnings of all wage-earners and of men, women, and children are shown, by geographic divisions, in Diagram 11.

The most effective method of making comparisons between the average earnings of men, women, and children in the several divisions and states is by referring all of them to the averages for the United States as a base. The average earnings of all wage-earners in 1905 were $10.06 for the week, and the corresponding averages for men, women, and children were $11.16, $6.17, and $3.46, respectively.

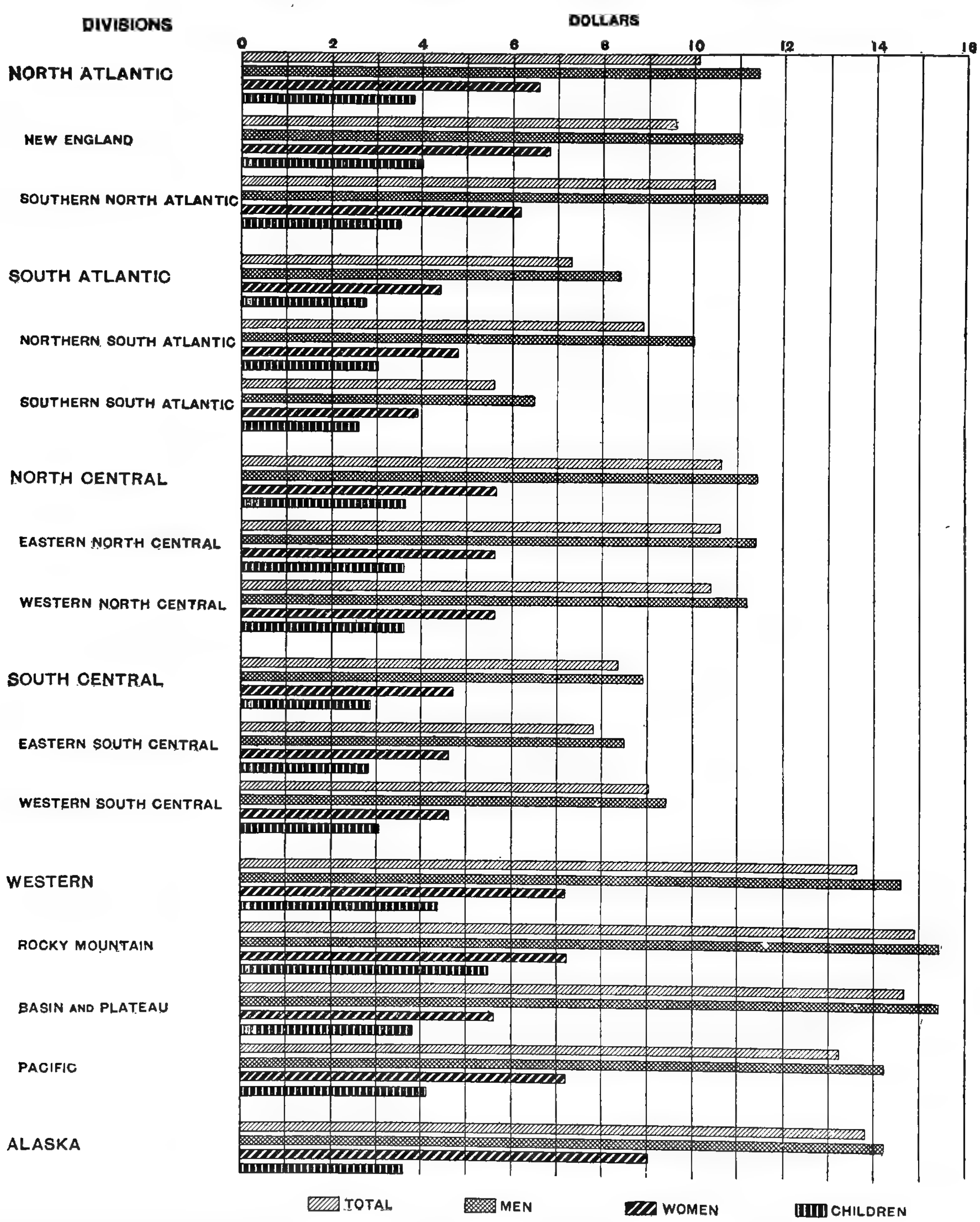
Diagrams 12 and 13 show, by percentages, how far the averages for the several geographic divisions and states deviate from those for the country as a whole. In these diagrams a marked deviation to the left means a very high average; to the right a very low average.

The average weekly earnings for the South Atlantic division differ but little, proportionately, from those for the country as a whole. In the North Central, South Central, and Western divisions, the averages for women are relatively low. In the North Atlantic the average for children is relatively high.

Of the three minor divisions in the Western group, the Pacific division is the most important from the standpoint of manufacture, and hence its averages are very similar to those for the Western division as a whole. The Rocky Mountain division has the highest rank; the high average for children in this division is

due very largely to the average for Montana, though Colorado also exerts a strong influence. The Basin and Plateau ranks second with respect to the average for men, the high average being common to Nevada and Arizona; but in the averages for women and children this division falls below the Pacific division, on account of the very low averages for Utah. The low average for women in the Western division as compared with that for men is common to all the states, but it is most conspicuous in the case of Utah. The average for children is relatively low in all the states except Montana, Colorado, Idaho, and Arizona.

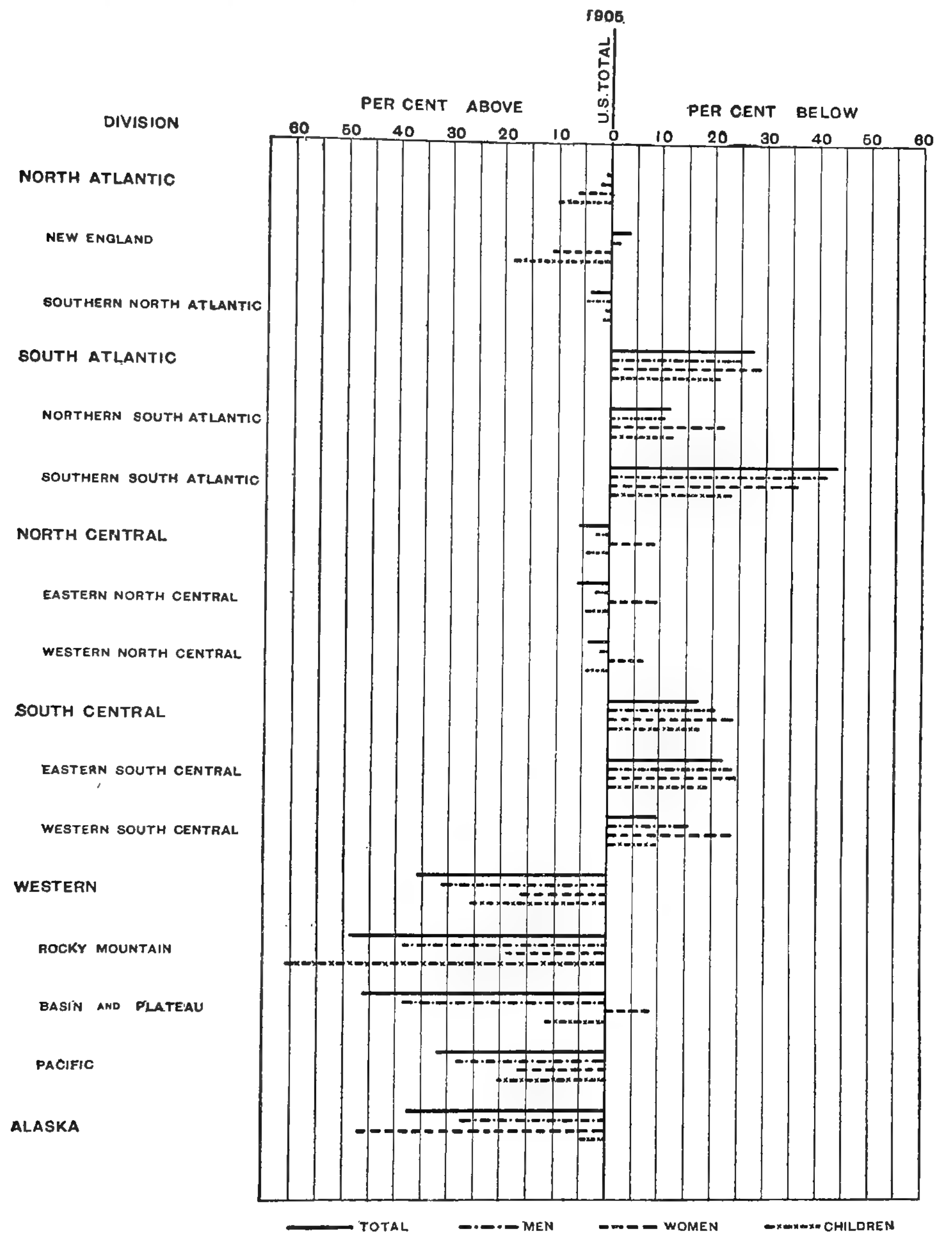
DIAGRAM 11.—CLASSIFIED WEEKLY EARNINGS—AVERAGE WEEKLY EARNINGS OF ALL WAGE-EARNERS, AND OF MEN, WOMEN, AND CHILDREN, BY GEOGRAPHIC DIVISIONS: 1905.



In the North Atlantic division the importance of the manufacturing interests of the Southern North Atlantic is reflected in the averages, which are very similar, both actually and proportionately, to those for the

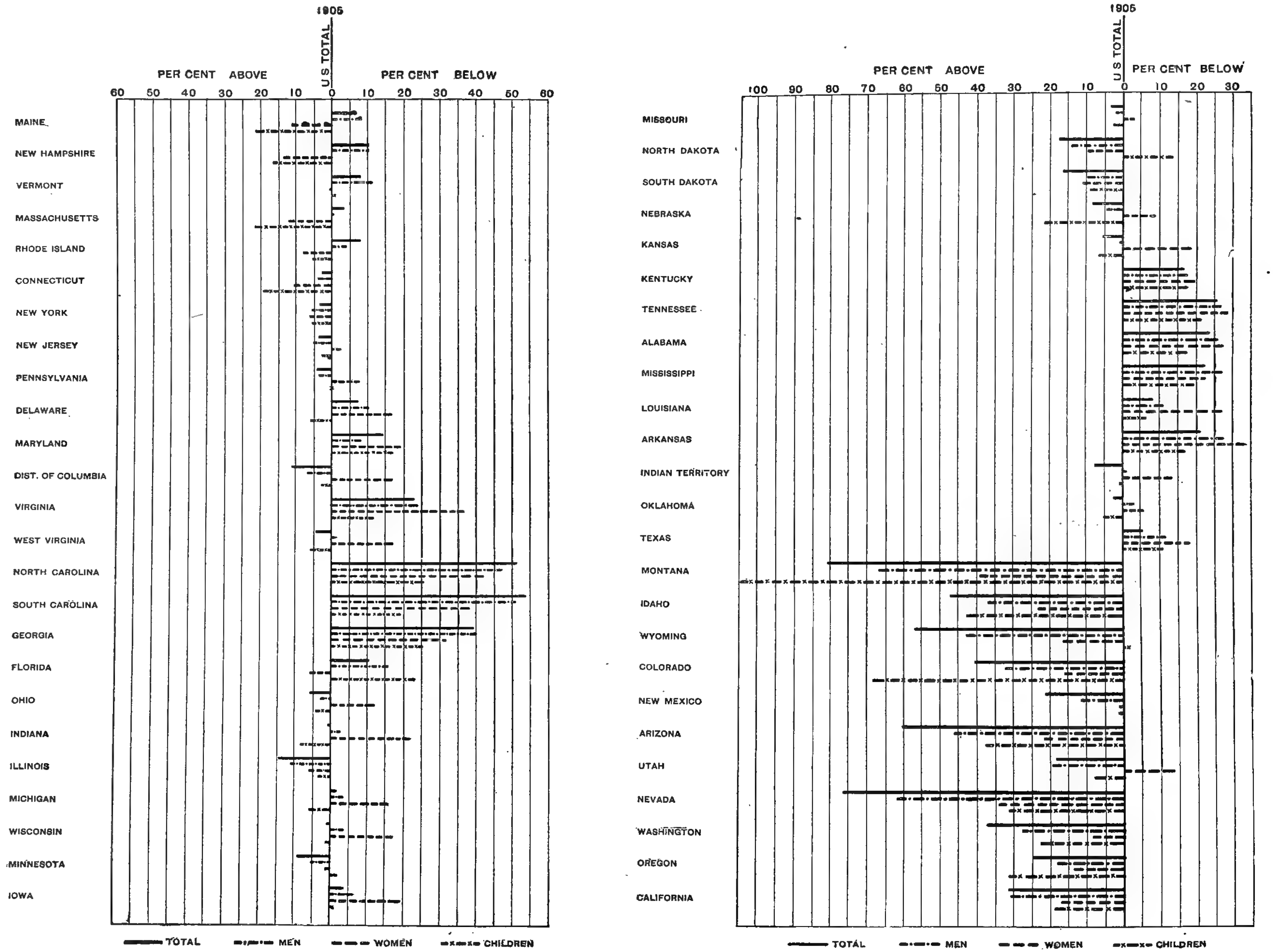
United States; the high average for women in New York is offset by low averages for the other 2 states of this group. But the averages for women and children in all of the New England states are so high as to have an appreciable effect upon the averages for the North Atlantic division as a whole.

DIAGRAM 12.—CLASSIFIED WEEKLY EARNINGS—PER CENT THAT AVERAGE EARNINGS OF ALL WAGE-EARNERS, AND OF MEN, WOMEN, AND CHILDREN ARE ABOVE OR BELOW AVERAGE FOR THE UNITED STATES, BY GEOGRAPHIC DIVISIONS: 1905.



The averages for both minor North Central divisions differ but little from those of the main division; the Eastern North Central is slightly higher for men and for children, and the Western North Central for women. The averages for women are relatively low in both minor divisions, and in all the states except Illinois, Minnesota, and North and South Dakota; the high averages in these 4 states are offset by relatively low averages for Indiana, Iowa, Kansas, and Wisconsin, the first-named state having the lowest.

DIAGRAM 13.—CLASSIFIED WEEKLY EARNINGS—PER CENT THAT AVERAGE EARNINGS OF ALL WAGE-EARNERS, AND OF MEN, WOMEN, AND CHILDREN ARE ABOVE OR BELOW AVERAGE FOR THE UNITED STATES, BY STATES AND TERRITORIES: 1905.



The averages for the South Atlantic division are similar, proportionately, to those for the United States, except that the average for children is rather high. The high average for children is common to all the Southern South Atlantic states except Florida; in the Northern South Atlantic the high averages for Delaware, Virginia, and West Virginia are offset by low averages for Maryland and the District of Columbia. The low average for women in the South Atlantic division is common to all states of the Northern South Atlantic; but in the Southern South Atlantic the averages are rather high—in Florida very high. Indeed, the average for all wage-earners in Florida, of the Southern South Atlantic group, is higher than that for either Maryland or Virginia of the Northern South Atlantic; leaving out the District of Columbia, the only South Atlantic states having higher averages are West Virginia and Delaware.

In the South Central division the averages for men and children, and also for all wage-earners, are rather higher in the Western South Central than in the Eastern South Central. But the averages for women, which are relatively low for both of these groups, are even lower in the former than in the latter. The relatively low average for women is common to all the states except Mississippi, the lowest absolute average of all being that for Arkansas. As might be expected, Indian Territory and Oklahoma show the highest averages in the South Central division.

Comparison between Western and Southern states.—The states ranking highest with respect to the average earnings of men, women, and children are in the Western division, and those ranking lowest are in the South Atlantic and South Central divisions.

TABLE 26.—HIGHEST AND LOWEST AVERAGE EARNINGS—TWELVE STATES COMPARED: 1905.

STATE OR DIVISION.	AVERAGE WEEKLY EARNINGS.						WAGE-EARNERS, ALL ESTABLISHMENTS, GREATEST NUMBER, PER CENT—			CONTROLLING INDUSTRIES.		
	Men 16 years and over.		Women 16 years and over.		Children under 16 years.		Of population.[1]	Of greatest number, United States.	In classified earnings.	Kind.	Wage-earners included in classified earnings.	
	Rank.	Amount.	Rank.	Amount.	Rank.	Amount.					Number.	Per cent of total for state or territory.
United States	......	$11.16	......	$6.17	......	$3.46	[2]8.5	100.0	47.0	......	......	......
Western division	1	14.62	1	7.17	1	4.35	6.9	4.5	42.7	......	......	......
Montana	1	18.60	2	8.60	1	7.09	3.9	0.2	40.9	Smelting and refining, copper; lumber and timber products.	2,967	63.2
Nevada	2	18.05	[illegible]	8.29	[illegible]	4.50	2.7	(3)	57.8	Lumber and timber products; cars and general shop construction and repairs by steam railroad companies; printing and publishing, newspapers and periodicals; brick and tile; foundry and machine shop products.	348	53.2
Arizona	3	16.27	5	7.50	4	4.77	4.3	0.1	56.4	Smelting and refining, copper; cars and general shop construction and repairs by steam railroad companies.	2,235	65.8
Wyoming	4	15.93	7	7.18	36	3.40	2.5	(3)	86.6	Cars and general shop construction and repairs by steam railroad companies.	1,489	68.5
Idaho	5	15.30	4	7.62	3	4.93	2.8	0.1	28.3	Lumber and timber products; beet sugar.	881	56.9
Colorado	[illegible]	14.78	8	7.14	2	5.84	5.0	0.4	42.5	Beet sugar; foundry and machine shop products; printing and publishing, newspapers and periodicals; coke; lumber and timber products; printing and publishing, book and job.	6,491	50.5
South Atlantic division	5	8.39	5	4.42	5	2.74	6.4	10.2	41.1	......	......	......
South Carolina	51	5.47	50	3.84	46	2.79	5.3	1.1	42.7	Cotton goods	20,933	64.6
North Carolina	50	5.92	51	3.60	51	2.58	5.5	1.6	45.7	Cotton goods; lumber and timber products.	28,927	56.5
Georgia	49	6.70	47	4.24	50	2.59	5.0	1.7	38.7	Cotton goods; lumber and timber products; turpentine and rosin.	23,862	50.8
South Central division	4	8.91	4	4.69	4	2.86	3.3	7.4	33.7	......	......	......
Arkansas	48	8.11	48	4.13	42	2.88	3.6	0.7	35.2	Lumber and timber products	10,961	61.6
Mississippi	47	8.15	43	4.79	47	2.78	3.1	0.7	23.8	Lumber and timber products; oil, cottonseed and cake.	7,597	60.7
Tennessee	[illegible]	8.17	46	4.37	48	2.73	3.9	1.2	39.6	Lumber and timber products; cars and general shop construction and repairs by steam railroad companies; cotton goods; foundry and machine shop products; woolen goods; flour and grist mill products; furniture; fertilizers.	16,588	50.1

1 Population estimated as of June 1, 1905, except for states in which a census was taken.
2 Hawaii not included.
3 Less than one-tenth of 1 per cent.

The disparity in rank according to earnings, of these divisions and the states selected from them, is not an indication of their relative importance in manufactures. The divisions must be judged, not only by earnings, but by their economic conditions, the character of their industries, and the relative importance they bear to the great manufacturing total of the country.

None of these divisions is so largely devoted to manufacture as are the two remaining divisions. The Western and the South Atlantic divisions have substantially a like proportion of their population earning wages in manufacturing establishments. Yet the importance of the South Atlantic division as an employer of manufacturing wage-earners is more than double that of the Western, and nearly double that of the South Central.

All three of the divisions mentioned follow, in the main, industries founded on natural resources. These are as a rule more numerous in the South Atlantic and South Central than in the Western, only one—lumber and timber products—being common to all three.

The South Atlantic and South Central divisions are comparatively new to the factory system, and earnings have not yet reached the higher level of similar industries in the old and highly developed factory communities. The Western division has not entered the factory system in a way to dominate its industrial activities, and earnings there are not affected by eastern factory conditions.

The differences between the earnings of men, women, and children in the Western and Southern divisions are attributable in part to differences in the character of the industries, and in part to variations in the cost, and perhaps in the standard, of living.

Two notable factors which tend to reduce all earnings in Southern states are the employment of large numbers of women and children and of negroes. In North Carolina and South Carolina the women and children together formed 35 and 37.2 per cent, respectively, of the total wage-earners; the corresponding percentage in Montana was but 3.9. The general tables show very clearly the important place women and children hold in the manufacture of cotton goods, and the dominating influence of this industry in the 2 states. In Montana, on the other hand, the dominating industries are the smelting and refining of copper and the manufacture of lumber and timber products—industries which employ few, if any, women or children.

While the cotton mills of the Carolinas employ but few negroes, it is quite otherwise in the manufacture of lumber and timber products. In the South the labor in this industry is to a large extent negro; in Montana it is white. As this is the only industry which is important in both the South and the West, a comparison of the earnings of men is given, in Table 27, for the Carolinas and Montana—together with Wyoming, which showed the highest earnings for this industry in the Western division.

TABLE 27.—EARNINGS OF MEN EMPLOYED IN THE MANUFACTURE OF LUMBER AND TIMBER PRODUCTS IN SELECTED STATES OF THE WESTERN AND SOUTH ATLANTIC DIVISIONS: 1905.

STATE.	Per cent number employed forms of number for all industries.	MEDIAN GROUPS AND AVERAGE WEEKLY EARNINGS.		PER CENT EARNING—			
		Median group of earnings.	Average weekly earnings.	Under $7.	$7 to $12.	$12 to $20.	$20 and over.
United States	6.7	$9 to $10	$9.25	27.6	50.4	19.1	2.9
Western division	20.5	12 to 15	13.97	4.9	23.8	59.8	11.5
Rocky Mountain	16.5	12 to 15	13.95	8.6	17.8	56.9	16.7
Montana	23.4	12 to 15	14.58	2.8	1.7	84.7	10.8
Wyoming	19.0	20 to 25	21.48	....	0.5	8.4	91.1
South Atlantic division	14.2	6 to 7	6.49	64.2	30.2	4.8	0.8
Southern South Atlantic	20.5	5 to 6	5.82	73.9	23.1	2.4	0.6
North Carolina	24.1	5 to 6	5.40	82.3	15.4	1.8	0.5
South Carolina	14.7	4 to 5	4.74	87.1	10.8	1.7	0.4

It will be noticed that the importance of the lumber industry, as measured by the number of men employed, is greater in the Southern South Atlantic, in which the lowest earnings are found, than it is in the corresponding main division, and hence greater than in the Northern South Atlantic. In the West the industry is less important in the Rocky Mountain division, in which the highest earnings are found, than it is in the corresponding main division, the Rocky Mountain division being far outranked by the Pacific division; the average earnings of men in this industry in California are $15.09—greater than in Montana, but less than in Wyoming.

In the case of sections of the country as widely separated as are the South Atlantic and Western divisions, a great disparity in earnings will at once suggest differences in the predominating industries and in local conditions. It is more difficult, however, to

account for a considerable difference in the earnings of all wage-earners in adjoining states—as North Carolina and Virginia.

Upon examining the statistics for these 2 states, it is found that of the wage-earners reported for North Carolina, 35 per cent were women and children, while for Virginia the corresponding percentage was but 16.6. The earnings of women and children were as a rule much lower than those for men, and the excess of women and children in North Carolina reduced the earnings for all wage-earners in the state.

Over two-fifths of the wage-earners reported for North Carolina were employed in the cotton mills. In this state the prevailing earnings not only in the cotton mills but in both classes of tobacco factories were exceptionally low, more than 95 per cent of the wage-earners receiving less than $8 for the week covered by the inquiry. Women and children formed 56.7 per cent of the total number employed in the cotton mills and 49.2 per cent of those in the tobacco factories, and more than two-thirds of them received less than $4 for the week.

Only 30.4 per cent of the wage-earners employed in the manufactures of Virginia were covered by the returns secured for this report. A greater variety of industries were reported for the state than were returned for North Carolina, and the wage-earners were more evenly distributed throughout the different branches of manufacture. There is no industry in Virginia that controls so large a proportion of the wage-earners of the state as do the cotton and tobacco manufactures of North Carolina.

Proportional numbers and earnings.—Invariably the percentage of men of total wage-earners in a division or state was less than their percentage of the earnings; it was the reverse in the case of women and children.

TABLE 28.—*Proportional numbers and earnings—men, women, and children—by states, territories, and geographic divisions: 1905.*

STATE OR TERRITORY.	PER CENT OF TOTAL.					
	Men 16 years and over.		Women 16 years and over.		Children under 16 years.	
	Number.	Earnings.	Number.	Earnings.	Number.	Earnings.
United States	79.4	88.1	17.9	11.0	2.7	0.9
North Atlantic division	74.6	84.2	22.9	14.8	2.5	1.0
New England	69.3	79.1	27.7	19.6	3.0	1.3
Maine	77.3	84.2	20.1	14.6	2.6	1.2
New Hampshire	68.5	76.1	30.3	23.4	1.2	0.5
Vermont	83.2	89.0	15.8	10.6	1.0	0.4
Massachusetts	67.3	77.5	29.6	21.2	3.1	1.3
Rhode Island	66.0	77.1	28.7	20.8	5.3	2.1
Connecticut	75.4	84.4	22.2	14.6	2.4	1.0
Southern North Atlantic	78.6	87.8	19.2	11.5	2.2	0.7
New York	74.0	83.9	25.1	15.8	0.9	0.3
New Jersey	77.7	87.7	19.8	11.5	2.5	0.8
Pennsylvania	83.8	92.0	12.8	6.9	3.4	1.1

TABLE 28.—*Proportional numbers and earnings—men, women, and children—by states, territories, and geographic divisions: 1905*—Con.

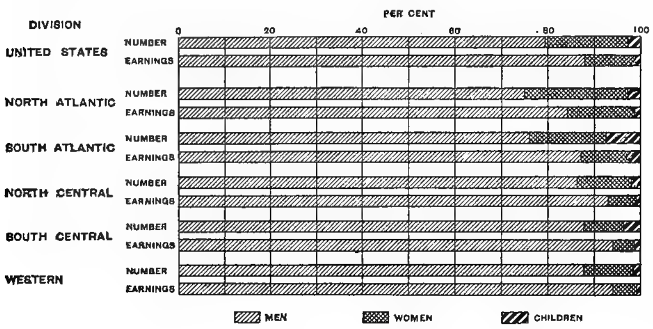
STATE OR TERRITORY.	PER CENT OF TOTAL.					
	Men 16 years and over.		Women 16 years and over.		Children under 16 years.	
	Number.	Earnings.	Number.	Earnings.	Number.	Earnings.
South Atlantic division	76.0	87.2	16.4	9.9	7.6	2.9
Northern South Atlantic	79.7	89.7	16.8	9.1	3.5	1.2
Delaware	85.8	92.5	11.9	6.6	2.3	0.9
Maryland	70.3	83.9	25.0	14.5	4.7	1.6
District of Columbia	89.8	95.5	8.9	4.1	1.3	0.4
Virginia	83.4	91.8	13.3	6.9	3.3	1.3
West Virginia	92.4	96.5	5.9	2.9	1.7	0.6
Southern South Atlantic	72.2	83.3	16.0	11.2	11.8	5.5
North Carolina	65.0	77.6	20.3	14.7	14.7	7.7
South Carolina	62.8	73.4	19.7	16.2	17.5	10.4
Georgia	81.0	89.0	10.9	7.6	8.1	3.4
Florida	89.6	92.8	9.5	6.9	0.9	0.3
North Central division	86.4	93.1	12.0	6.4	1.6	0.5
Eastern North Central	86.7	93.2	11.9	6.3	1.4	0.5
Ohio	86.2	93.2	12.6	6.4	1.2	0.4
Indiana	87.4	94.2	10.9	5.2	1.7	0.6
Illinois	86.7	92.8	12.0	6.8	1.3	0.4
Michigan	85.1	92.4	13.6	7.1	1.3	0.5
Wisconsin	89.6	95.1	8.1	4.1	2.3	0.8
Western North Central	85.6	92.5	12.2	6.8	2.2	0.7
Minnesota	86.8	92.6	12.6	7.2	0.6	0.2
Iowa	85.9	93.1	12.0	6.1	2.1	0.8
Missouri	82.9	90.8	14.2	8.2	2.9	1.0
North Dakota	85.9	92.6	12.0	6.9	2.1	0.5
South Dakota	90.3	94.7	8.2	4.8	1.5	0.5
Nebraska	87.8	94.0	9.9	5.1	2.3	0.9
Kansas	90.2	95.6	7.6	3.6	2.2	0.8
South Central division	87.9	94.0	8.4	4.7	3.7	1.3
Eastern South Central	85.0	92.2	10.2	6.1	4.8	1.7
Kentucky	82.4	90.5	14.1	8.3	3.5	1.2
Tennessee	84.6	92.2	10.4	6.0	5.0	1.8
Alabama	85.8	93.1	7.5	4.4	6.7	2.5
Mississippi	91.6	95.9	4.4	2.7	4.0	1.4
Western South Central	92.5	96.4	5.6	2.9	1.9	0.7
Louisiana	86.4	93.7	10.7	5.3	2.9	1.0
Arkansas	96.4	98.4	2.0	1.0	1.6	0.6
Indian Territory	95.4	98.0	3.0	1.5	1.6	0.5
Oklahoma	90.4	95.0	7.6	4.3	2.0	0.7
Texas	93.7	97.0	4.7	2.5	1.6	0.5
Western division	87.6	93.8	10.9	5.7	1.5	0.5
Rocky Mountain	93.9	97.2	4.7	2.3	1.4	0.5
Montana	96.1	98.2	2.7	1.3	1.2	0.5
Idaho	94.3	97.4	3.9	2.0	1.8	0.6
Wyoming	98.0	99.2	1.8	0.8	0.2	(1)
Colorado	91.9	96.0	6.7	3.4	1.4	0.6
New Mexico	97.1	99.1	0.4	0.2	2.5	0.7
Basin and Plateau	92.7	97.5	5.3	2.0	2.0	0.5
Arizona	98.7	99.5	0.9	0.4	0.4	0.1
Utah	83.3	93.1	12.1	5.4	4.6	1.5
Nevada	97.3	98.8	2.1	1.0	0.6	0.2
Pacific	85.8	92.7	12.6	6.8	1.6	0.5
Washington	96.2	98.2	3.4	1.7	0.4	0.1
Oregon	90.5	94.9	8.2	4.6	1.3	0.5
California	82.3	90.8	15.8	8.6	1.9	0.6
Alaska	94.1	97.0	3.7	2.4	2.2	0.6

[1] Less than one-tenth of 1 per cent.

When the main geographic divisions are ranked according to the proportions of men, women, or children among their wage-earners, and then according to the corresponding proportions of their total earnings, it is found that the ranking by earnings does not differ in any instance from that by numbers.

The proportions for men were greatest in the South Central division, followed by the Western, North Central, South Atlantic, and North Atlantic, in the order named. For the proportions of women, the rank is exactly reversed, so that the North Atlantic ranked first and the South Atlantic second. With respect to children, however, the South Atlantic ranked first and the South Central second; the relative order of the other three divisions was the same as for women.

DIAGRAM 14.—*Classified weekly earnings—number and earnings of men, women, and children, by geographic divisions: 1905.*



Within 1.3 per cent of the entire number of wage-earners in Arizona were men, giving the territory first rank; the state having the least percentage of men was South Carolina, with less than two-thirds.

New Hampshire reported the largest percentage of women—nearly one-third—closely followed by Massachusetts and Rhode Island. New Mexico reported the least, four-tenths of 1 per cent.

The children were proportionately most numerous in South Carolina where they constituted nearly one-fifth of the total wage-earners shown; North Carolina was second and Wyoming last.

GEOGRAPHIC DIVISIONS.

Tables 24, 28, 69, 70, and 72 contain statistics upon which this discussion is based. Table 24 gives, among other information, the average weekly earnings of all wage-earners, and of men, women, and children, with the median group, for each geographic division, state, and territory; Table 28, the percentages the number and earnings of men, women, and children are of the totals for the division, state, or territory; Table 69, the number of establishments and earnings of all wage-earners and of men, women, and children in the various groups, by geographic divisions, both major and minor, and by states and territories; Table 70 distributes by percentages the number of men, women, and children in the several groups; and Table 72 presents establishments, average weekly earnings of all wage-earners and of men, women, and children, with total earnings and per cent distribution in selected industries for 25 leading states.

In every instance the analysis of the statistics of states shown by selected industries deals with the selected industries only. In the other states or territories the analysis concerns all the industries reported having 3 establishments or more.

New England division.—According to the returns for the census of 1905, New England manufactured more than one-half in value of the boots and shoes, and of the cotton, the woolen, and the worsted goods made in the United States; likewise over one-half of the value of products of several other industries of less magnitude, as ammunition; boots and shoes, rubber; brass and copper, rolled; brassware; clocks; plated ware; and silversmithing and silverware; and a very large proportion of the felt hats, jewelry, cutlery and edge tools, and rubber and elastic goods.

TABLE 29.—NEW ENGLAND DIVISION—NUMBER AND PER CENT OF ESTABLISHMENTS AND WAGE-EARNERS INCLUDED IN WEEKLY EARNINGS, BY STATES: 1905.

ESTABLISHMENTS AND WAGE-EARNERS.	New England division.	Maine.	New Hampshire.	Vermont.	Massachusetts.	Rhode Island.	Connecticut.
Establishments, total number	22,279	3,145	1,618	1,699	10,723	1,617	3,477
Reporting no wage-earners	1,518	256	136	69	737	85	235
Reporting wage-earners	20,761	2,889	1,482	1,630	9,986	1,532	3,242
Included in weekly earnings	15,166	1,711	810	859	8,724	1,092	1,970
Per cent	73.1	59.2	54.7	52.7	87.4	71.3	60.8
Wage-earners, greatest number	1,131,225	112,110	79,055	42,568	578,208	110,838	208,446
Included in weekly earnings	749,993	43,277	29,874	20,065	487,048	68,140	101,589
Per cent	66.3	38.6	37.8	47.1	84.2	61.5	48.7

Classified earnings of the wage-earners employed in nearly three-fourths of the employing establishments in the division are included in these statistics, and the number of wage-earners thus included forms nearly two-thirds of the greatest number employed at any one time during the year.

The greatest proportion of both establishments and wage-earners is shown for Massachusetts, the smallest proportion of establishments for Vermont, and the smallest proportion of wage-earners for New Hampshire. Among the industries selected as leading manufactures of the states, one—rubber boots and shoes—in Massachusetts and Connecticut is represented by all wage-earners. In many of the industries the earnings shown are for from three-fourths to nine-tenths of the wage-earners, in a considerable number they are for one-half or more, and in 22 for somewhat less than one-half. In this important manufacturing division, there

fore, the satisfactory returns are unusually numerous. The dominant factor in the returns for the division is Massachusetts, the establishments for that state constituting more than one-half of the total shown, and the wage-earners nearly two-thirds.

TABLE 30.—NEW ENGLAND DIVISION—NUMBER AND PER CENT OF WAGE-EARNERS AT EACH AMOUNT OF CLASSIFIED EARNINGS, BY STATES: 1905.

WEEKLY EARNINGS.	NEW ENGLAND DIVISION.		MAINE.		NEW HAMPSHIRE.		VERMONT.		MASSACHUSETTS.		RHODE ISLAND.		CONNECTICUT.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Total	749,993	100.0	43,277	100.0	29,874	100.0	20,065	100.0	487,048	100.0	68,140	100.0	101,589	100.0
Less than $3	16,120	2.2	1,048	2.4	639	2.1	705	3.5	9,774	2.0	1,789	2.6	2,165	2.1
$3 to $4	25,841	3.5	1,350	3.1	913	3.1	716	3.6	16,671	3.4	2,997	4.4	3,194	3.1
$4 to $5	43,600	5.8	2,152	5.0	1,453	4.9	820	4.1	29,335	6.0	4,812	7.1	5,028	5.0
$5 to $6	57,695	7.7	2,433	5.6	2,285	7.6	930	4.6	39,573	8.1	6,230	9.2	6,244	6.1
$6 to $7	77,437	10.3	3,881	9.0	3,624	12.1	1,867	9.3	51,305	10.5	8,332	12.2	8,428	8.3
$7 to $8	76,694	10.2	4,139	9.6	3,643	12.2	2,568	12.8	49,353	10.1	7,763	11.4	9,228	9.1
$8 to $9	68,831	9.2	3,812	8.8	2,984	10.0	2,239	11.2	44,701	9.2	6,212	9.1	8,883	8.7
$9 to $10	86,326	11.5	8,230	19.0	4,337	14.5	3,252	16.2	52,060	10.7	5,871	8.6	12,576	12.4
$10 to $12	96,996	12.9	6,318	14.6	4,373	14.6	2,646	13.2	61,469	12.6	7,847	11.5	14,343	14.1
$12 to $15	98,167	13.1	5,569	12.9	3,274	11.0	2,398	11.9	63,557	13.1	8,268	12.1	15,101	14.9
$15 to $20	79,040	10.5	3,554	8.2	1,989	6.7	1,592	7.9	53,084	10.9	6,166	9.1	12,655	12.5
$20 to $25	16,447	2.2	581	1.3	299	1.0	255	1.3	11,401	2.4	1,239	1.8	2,672	2.6
$25 and over	6,799	0.9	210	0.5	61	0.2	77	0.4	4,765	1.0	614	0.9	1,072	1.1
Earnings for the specified week:														
Total	$7,251,712		$406,537		$270,034		$185,447		$4,713,422		$626,215		$1,050,057	
Average per wage-earner	$9.67		$9.39		$9.04		$9.24		$9.68		$9.19		$10.34	

The average weekly earnings of, all wage-earners were considerably lower, and for men a little lower, than for the United States. In average earnings Connecticut led. The distribution at the higher amounts in New Hampshire is not so favorable to a high average as the distribution in Rhode Island, and the average earnings in the more northerly state are shown to have been the lowest in the division.

Over two-thirds of the wage-earners in the division were men, more than one-fourth women, and less than one-thirtieth children. Vermont, with its marble works and lumber and timber products, had the greatest, and Rhode Island, with its textile industries, the least proportion of men; New Hampshire, also a state of textile factories, had the greatest proportion of women, and Rhode Island the greatest proportion of children. Vermont had the least proportionate number of both women and children, although the proportion of children for New Hampshire was not much larger; Massachusetts was second greatest. For each of 15 of its selected industries the division reported more than one-half of the wage-earners returned for these industries in the United States. Among the more prominent industries the percentage ranged from 76.2 for worsted goods to 60.4 for cotton goods. In the less prominent the range was from 90.8 per cent for rubber boots and shoes to 60 per cent for hardware.

Vermont is the only state in the division for which selected industries are not shown in Table 72. Of the industries presented for the other states, cotton goods, foundry and machine shop products, and woolen goods were common to all the 5; boots and shoes and hosiery and knit goods, to 4; worsted goods, to 3; and dyeing and finishing textiles, electrical machinery, apparatus, and supplies, jewelry, lumber and timber products, paper and wood pulp, printing and publishing newspapers and periodicals, and rubber and elastic goods, to 2.

TABLE 31.—*New England division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905.*

[Size of establishments determined by the average number of wage-earners employed during the year.]

STATE.	Number of wage-earners.	PER CENT IN EACH CLASS OF ESTABLISHMENTS.					
		Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
		ALL WAGE-EARNERS.					
New England division	749,993	6.2	13.2	16.6	14.5	11.8	37.7
Maine	43,277	17.9	18.6	26.7	10.0	6.1	20.7
New Hampshire	29,874	8.7	11.9	13.8	15.6	12.4	37.6
Vermont	20,065	14.0	14.2	21.5	13.3	15.7	21.3
Massachusetts	487,048	5.1	14.2	16.2	14.9	11.8	37.8
Rhode Island	68,140	4.4	10.7	14.3	14.9	16.6	39.1
Connecticut	101,589	5.4	7.8	15.4	14.0	10.5	46.9
		MEN 16 YEARS AND OVER.					
New England division	519,883	7.7	14.7	17.4	14.2	11.6	34.4
Maine	33,448	20.0	19.0	27.9	10.0	5.1	18.0
New Hampshire	20,473	11.5	15.1	15.7	16.4	13.2	28.1
Vermont	16,688	15.5	14.9	20.9	8.9	16.2	23.6
Massachusetts	327,717	6.3	16.1	17.0	14.9	11.8	33.9
Rhode Island	44,978	5.5	11.8	15.2	15.2	15.6	36.7
Connecticut	76,579	6.4	8.3	15.7	13.2	9.8	46.6
		WOMEN 16 YEARS AND OVER.					
New England division	207,381	2.8	10.2	15.3	15.3	12.1	44.3
Maine	8,684	10.5	16.5	23.8	10.5	8.5	30.2
New Hampshire	9,035	2.7	5.2	9.5	13.6	10.4	58.6
Vermont	3,170	5.7	10.7	24.4	36.8	12.9	9.5
Massachusetts	144,380	2.5	10.9	15.2	15.1	11.6	44.7
Rhode Island	19,537	2.2	9.2	13.9	13.9	18.4	42.4
Connecticut	22,575	2.4	6.2	14.9	16.6	12.1	47.8
		CHILDREN UNDER 16 YEARS.					
New England division	22,729	3.2	6.3	10.3	13.7	13.6	52.9
Maine	1,145	12.2	23.2	15.6	6.9	17.7	24.4
New Hampshire	366	3.8	2.7	10.4	18.9	17.5	46.7
Vermont	207	12.1	7.2	29.5	12.1	23.7	15.4
Massachusetts	14,951	2.7	5.8	10.2	13.0	11.3	57.0
Rhode Island	3,625	1.5	4.5	6.1	16.3	19.0	52.6
Connecticut	2,435	3.4	5.2	12.9	17.1	16.0	45.4

Of all wage-earners, 64 per cent were returned by factories employing an annual average of 150 or more wage-earners. These larger factories reported more than three-fifths of the men, nearly three-fourths of the women, and more than four-fifths of the children.

Among the states there was not much difference between Connecticut and Rhode Island in the percentage of all wage-earners and of men in the larger establishments, although Connecticut was first in both. New Hampshire had the greatest percentage of women in the larger establishments and Rhode Island the greatest percentage of children. Massachusetts occupied an intermediate position in rank according to percentages, but much more than one-half of its wage-earners of the various classes were in the larger establishments. Maine had the least percentage of all wage-earners, and of men, women, and children in the larger factories.

The wage-earners in 10 leading industries in Maine shown in Table 72 comprise nearly three-fourths of the wage-earners included for this state for the selected week. The average earnings of men in the selected industries were $10.15, an amount which is a little below the average of men for the state. The industry employing the largest number of men was lumber and timber products, the average earnings in which were 84 cents below the average for the selected industries. Other industries, 6 in number, with a higher average and a greater combined number of men, more than offset the effect of this lower level. The average earnings of women for all the industries shown for the state were $6.84; for the selected industries they were $7.21. In 3 industries the averages were greater than the average for the selected manufactures, and in 4 they were higher than for the state. The industry employing the most women was cotton goods; the average earnings for this were lower than either those for the state or for the selected 10. Children's average earnings for the state were $4.20, and for the selected industries only 1 cent less. The industry employing the largest number of children was canning and preserving fish, in which the earnings were much higher than for either the state or the selected industries. Of the selected industries, those showing highest and lowest average earnings were—for men, marble and stone work, $13.95, and cotton goods, $8.16; for women, canning and preserving fish, $8.80, and printing and publishing newspapers and periodicals, $5.84; for children, canning and preserving fish, $5.07, and boots and shoes, $2.

Six of the leading industries of New Hampshire employed over two-thirds of the wage-earners for the selected week. The average earnings of men in the 6 industries were $9.65, which was considerably less than for all industries included for the state. Four reported averages higher than those for the selected group, and in 2 of these the averages were higher than the average for the state. Cotton goods reported the largest number of men, and the average earnings, $8.67, were lower than in any other of the industries shown. The highest average earnings, $11.25, were paid to the wage-earners in foundry and machine shops. Women earned $7.06 on the average in the selected industries, a little larger average than for the state. They were employed in largest numbers in the manufacture of cotton goods, in which their average earnings were within 1 cent of the average for the selected industries. The highest average, $7.31, is shown for boots and shoes; the lowest, $6, for foundry and machine shop products. Children were not numerous, but were most largely employed in the cotton goods industry, in which their average earnings, $4.18, were higher than for the state or for the selected manufactures, these being respectively $4.04 and $4.09. Children's earnings averaged highest, $4.70, in woolen goods, and lowest, $2.36, in hosiery and knit goods.

Vermont has several important manufactures, the most notable being marble and stone work, woolen goods, lumber and timber products, foundry and machine shop products, and scales and balances. The average earnings of men were $9.89. The industry employing the largest number was marble and stone work, the average earnings in which were $9.44. The average of $14.87 for monuments and tombstones was highest, and that for gas, illuminating and heating, $5.48, was lowest. Women earned on the average $6.19. The industry in which they were most largely reported was woolen goods, with average earnings of $7.32, the highest in the state. The lowest average earnings, $3, were reported for the manufacture of butter. The average earnings of children were $3.45; in the industry in which they were most largely employed, woolen goods, they earned $4.02, or much more than this general average. But their highest average, $8, was reported for the paper and wood pulp manufacture; their lowest, $1.05, for woodenware, not elsewhere specified.

The most important industry in Massachusetts, among industries selected to represent the state, measured by the number of men returned, was that of cotton goods, in which the average earnings were $8.53, compared with $11.15 for all industries in the state. The next in importance was boots and shoes; the average in this was $12.79. The highest average earnings, $16.17, for men were shown for the printing and publishing of newspapers and periodicals; the lowest, $8.53, for cotton goods. Women earned on the average in the selected industries $7.14, which is higher than the average of $6.91 shown for the state. In the manufacture in which they were most numerous, that of cotton goods, their average earnings were $6.79. The highest average, $8.48, for women was earned in the manufacture of rubber boots and shoes, and the lowest, $6.13, in paper and wood pulp. Children's average earnings for the selected industries were $4.32, 12 cents

above those for the state. Cotton goods was the manufacture in which they were most largely employed, and in this their average was \$4.42—higher than for both the selected industries and the state. The average earnings were \$5.14, the highest of all, in paper and wood pulp, and lowest, \$3.25, in printing and publishing, newspapers and periodicals.

The 10 leading industries selected for Rhode Island are nearly all pronouncedly factory industries. Men earned \$10.39 on the average in the selected industries, and \$10.73 in the state, the greatest number being reported for cotton goods, in which their average was \$8.42, and the next greatest for worsted goods, in which it was \$10.48. The general average was greatly increased, also, by the large quota of men in foundry and machine shop products, where their average earnings were \$11.98. The greatest average earnings were \$13.42 in silversmithing and silverware; the least, \$7.76, were returned for electrical machinery, apparatus, and supplies. The average earnings of women were \$6.66 for the state and \$6.74 for the selected industries. The largest number was reported for cotton goods, but nearly the same number for worsted goods. The average earnings in the former manufacture were \$6.44 and in the latter \$7.38. Woolen goods reported the highest average, \$7.80, and electrical machinery, apparatus, and supplies the lowest, \$5.49. Children were most numerously reported for worsted goods, in which their average earnings were \$3.59, and the next largest number for cotton goods, in which their average earnings were \$3.61. These earnings may be measured by the general average of \$3.65 for the selected industries, which was exactly the same as for the state. Children averaged the greatest earnings, \$4.34, in dyeing and finishing textiles, and the least, \$3, in silversmithing and silverware.

The 15 selected industries shown for Connecticut embrace 60.2 per cent of the number in the specified week shown for all industries in the state. All are purely factory industries, and none can be called distinctively rural. The average earnings of men in the selected industries were \$11.44, 13 cents less than for the state. The industry employing the largest number was brass and copper, rolled, the earnings averaging \$11.99, or a little more than the general average. Hardware and foundry and machine shop products employed the next largest numbers, the average earnings in these being respectively \$10.56 and \$11.45. The highest average, \$14.63, was in plated ware; the lowest, \$8.26, in cotton goods. Women earned an average of \$7.01 in the selected industries, a little more than in the state at large. They were returned in the largest number by cotton factories, the earnings averaging \$6.71. The highest average earned was \$8.42, in the manufacture of rubber boots and shoes; the lowest, \$5.13, in hardware. The average earnings of children in the state were \$4.14, or a trifle less than for the selected industries. The manufacture of cotton goods, with an average of \$4.02, engaged the largest number. The highest average, \$5.16, was earned in the manufacture of brass and copper, rolled; the lowest, \$3, in the making of corsets.

Southern North Atlantic division.—This geographic division comprises 3 important manufacturing states, in which are located establishments that produced more than one-half of the value of products reported for the entire country, for blast furnaces, rolling mills and steel works, and petroleum refineries, and for the manufacture of carpets and rugs, men's and women's clothing, felt hats, hosiery and knit goods, silk and silk goods, electrical machinery, apparatus, and supplies, and cigars and cigarettes. In addition, the division ranked first in the manufacture of leather, glass, and pottery and other clay products, and in book and job printing. The magnitude and variety of the industries covered give peculiar significance to the statistics of classified earnings.

TABLE 32.—*Southern North Atlantic division—number and per cent of establishments and wage-earners included in weekly earnings, by states: 1905.*

ESTABLISHMENTS AND WAGE-EARNERS.	Southern North Atlantic division.	New York.	New Jersey.	Pennsylvania.
Establishments, total number	67,699	37,194	7,010	23,495
Reporting no wage-earners	6,378	3,625	577	2,176
Reporting wage-earners	61,321	33,569	6,433	21,319
Included in weekly earnings	36,388	19,030	4,153	13,205
Per cent	59.3	56.7	64.6	61.9
Wage-earners, greatest number	2,321,924	1,075,570	321,669	924,685
Included in weekly earnings	976,648	430,475	139,862	406,311
Per cent	42.1	40.0	43.5	43.9

Setting aside the establishments for which no wage-earners were reported, the statistics of classified earnings cover practically three-fifths of all factories included in the census of 1905. Among the states the largest proportion is shown for New Jersey and the smallest for New York.

While the total number of wage-earners included in this geographic division forms rather less than one-half of the greatest number employed at any one time during the year, for a number of the important industries the proportion is considerably greater, so that the figures may be considered as representative of the weekly earnings in the majority of the manufactures. Although New York, which is the most important manufacturing state of the division, shows the largest number of wage-earners for the statistics of classified weekly earnings, the proportion that this number forms of the greatest number employed at any one time during the year in all establishments is slightly less than the corresponding proportions for the 2 other states of the group.

TABLE 33.—*Southern North Atlantic division—number and per cent of wage-earners at each amount of classified earnings, by states: 1905.*

WEEKLY EARNINGS.	SOUTHERN NORTH ATLANTIC DIVISION.		NEW YORK.		NEW JERSEY.		PENNSYLVANIA.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Total	976,648	100.0	430,475	100.0	139,862	100.0	406,311	100.0
Less than $3	31,705	3.2	12,920	3.0	4,862	3.5	13,923	3.4
$3 to $4	44,275	4.5	19,817	4.6	6,829	4.9	17,629	4.4
$4 to $5	55,150	5.7	26,891	6.3	8,473	6.1	19,786	4.9
$5 to $6	57,874	5.9	28,514	6.6	8,727	6.2	20,633	5.1
$6 to $7	66,238	6.8	31,482	7.3	9,559	6.8	25,197	6.2
$7 to $8	74,798	7.7	34,127	7.9	10,594	7.6	30,077	7.4
$8 to $9	79,948	8.2	32,619	7.6	11,423	8.2	35,906	8.8
$9 to $10	110,013	11.3	46,914	10.9	14,837	10.6	48,262	11.9
$10 to $12	135,112	13.8	56,512	13.1	17,971	12.8	60,629	14.9
$12 to $15	141,901	14.5	61,244	14.2	18,948	13.5	61,709	15.2
$15 to $20	124,931	12.8	53,561	12.4	19,720	14.1	51,650	12.7
$20 to $25	35,225	3.6	16,574	3.9	5,247	3.8	13,404	3.3
$25 and over	19,478	2.0	9,300	2.2	2,672	1.9	7,506	1.8
Earnings for the specified week: Total	$10,202,824		$4,476,464		$1,456,513		$4,269,847	
Average per wage-earner	$10.45		$10.40		$10.41		$10.51	

Of the wage-earners included in the statistics of weekly earnings for this division, 44.1 per cent were in New York, 41.6 per cent in Pennsylvania, and 14.3 per cent in New Jersey.

For the division as a whole a little over three-fourths of the wage-earners were men, nearly one-fifth were women, and about one-fortieth were children. For New Jersey the proportions were about the same. But the proportions of men and children were larger in Pennsylvania, and the proportion of women was larger in New York, which reported, in 1905, nearly one-fourth of the average number of women employed in manufacture in the United States. In each of these 2 states the proportion the number of women formed of the total number of wage-earners was nearly double their proportion of the total earnings, and the percentage of children was about three times as great as their percentage of earnings.

Among the Southern North Atlantic states the average earnings of men, women, and children were highest in New York and lowest in Pennsylvania. Of the average for all wage-earners, however, the reverse was true, Pennsylvania being highest and New York lowest; this was due to the large proportion of men in Pennsylvania and of women in New York, to which attention has already been called.

The 3 selected industries, appearing for all 3 states in which the Southern North Atlantic division exerted the strongest numerical influence upon the United States totals of earnings, were silk and silk goods; clothing, women's; and tobacco, cigars and cigarettes. Of the total number of wage-earners engaged in these industries, this division gave employment to 71.8, 61.3, and 46.1 per cent, respectively. Although glass is shown as a leading industry in 2 states only, statistics were returned for it from all 3; of all wage-earners included for the industry the division reported 50.8 per cent. The division also employed more than half of all wage-earners engaged in petroleum refining and in the manufacture of coke, felt hats, millinery and lace goods, and collars and cuffs. In the last-named industry 99.6 per cent of all wage-earners were employed in New York.

Measured by the number of wage-earners included in the statistics, the most important manufacturing industry in the division was foundry and machine shop products. Next in order were the allied industries of iron and steel, steel works and rolling mills, and steam railroad repair shops. Following these were tobacco, cigars and cigarettes; clothing, women's; bread and other bakery products; silk and silk goods; clothing, men's; and glass.

TABLE 34.—*Southern North Atlantic division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905.*

[Size of establishments determined by the average number of wage-earners employed during the year.]

STATE.	Number of wage-earners.	PER CENT IN EACH CLASS OF ESTABLISHMENTS.					
		Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
	ALL WAGE-EARNERS.						
Southern North Atlantic division	976,648	11.0	15.1	19.1	14.7	10.7	29.4
New York	430,475	13.5	19.0	21.0	14.3	10.8	21.4
New Jersey	139,862	8.5	12.9	19.5	15.0	13.9	30.2
Pennsylvania	406,311	9.3	11.9	16.9	14.9	9.5	37.5
	MEN 16 YEARS AND OVER.						
Southern North Atlantic division	767,566	12.1	14.9	18.2	14.2	10.3	30.3
New York	318,390	15.6	19.3	20.3	14.7	9.7	20.4
New Jersey	108,669	9.8	12.7	19.7	15.3	14.6	27.9
Pennsylvania	340,507	9.6	11.4	15.9	13.4	9.4	40.3
	WOMEN 16 YEARS AND OVER.						
Southern North Atlantic division	187,692	7.0	16.6	22.4	15.7	12.4	25.9
New York	108,083	7.5	18.0	23.3	13.1	14.0	24.1
New Jersey	27,690	3.3	13.4	18.9	14.6	10.9	38.9
Pennsylvania	51,919	8.0	15.3	22.2	21.7	9.9	22.9
	CHILDREN UNDER 16 YEARS.						
Southern North Atlantic division	21,390	7.6	12.5	19.7	22.3	11.5	26.4
New York	4,002	12.4	14.2	17.6	15.3	11.0	29.5
New Jersey	3,503	7.6	11.9	17.2	10.9	16.9	35.5
Pennsylvania	13,885	6.3	12.2	20.9	27.2	10.3	23.1

If the establishments employing at least 150 wage-earners are classed as large and all others as small, it is found that in the division the large establishments employed more than one-half of the men and women and three-fifths of the children.

For New York the proportion of wage-earners in large establishments was less than for the division as a whole, the proportion of men, and even of all wage-earners, being less than one-half. Pennsylvania re-

ported the greatest proportion of all wage-earners and men, more than three-fifths in each instance, and New Jersey the greatest proportion, more than three-fifths, of women and children in large establishments. Indeed, the proportions of men, women, and children employed in New Jersey in establishments having 300 or more wage-earners were nearly as great as the proportions employed in New York in establishments having 150 or more wage-earners.

The average weekly earnings of men employed in all industries in New York were $11.79. For 14 of the selected industries shown in Table 72 the average earnings of men were greater than they were for the state as a whole. The industry of greatest importance, as measured by both the number of all wage-earners and of men employed, was foundry and machine shop products. The average earnings of men were highest, $16.22, in printing and publishing, newspapers and periodicals; and lowest, $8.59, in canning and preserving, fruits and vegetables. The average for women in all industries of the state was $6.54. For 2 of the selected industries no women were reported; for 11 their average earnings were higher than their average for the state. The industry employing the largest number of women was women's clothing. The highest average earnings of women were $9.50, in steam railroad repair shops. The lowest average earnings were $4.50, in gas, illuminating and heating. The average for all children in the state was $3.64. Seven of the 25 industries for which children were reported showed average earnings higher than the average for the state; the average for bookbinding and blank book making was the same as the state average. The industry leading in number of children was hosiery and knit goods. Children's earnings averaged highest, $4.50, in brick and tile, and lowest, $2.71, in boxes, fancy and paper.

Slightly less than one-half of the wage-earners reported for New Jersey for the selected week were employed in 18 industries. All the establishments engaged in petroleum refining are included in these statistics. For 2 industries about three-fourths of the wage-earners are shown, and for 6 others the proportion is over one-half. The lowest proportion for any of the selected industries is about one-fifth.

The average weekly earnings of men employed in all industries in the state were $11.75. Of the 18 selected industries, 7 showed averages higher than the average for the state as a whole. The industry reporting the largest number of men was foundry and machine shop products. It was in hats, felt, that the highest average earnings, $15.14, were paid, and in worsted goods the lowest, $8.68. The weekly earnings of women averaged $6.03 for all industries. For 7 of the selected industries the average was higher than that for the state as a whole; of these, 2 were textile industries. For silk and silk goods the greatest number of women was reported, but for tobacco, cigars and cigarettes, the number was nearly as large. Earnings averaged highest, $7.72, in hats, felt, and lowest in glass, $4.09. The average for all children employed in the state was $3.55. Of the selected industries, the averages for 8 were higher than the average for the state as a whole. Worsted goods led in numbers, cotton goods was second, and tobacco, cigars and cigarettes, third, with silk and silk goods fourth. Compensation received averaged highest, $4.45, in petroleum refining, and lowest, $2.64, in tobacco, cigars and cigarettes.

The 27 industries selected for Pennsylvania employed about two-thirds of all wage-earners included in the statistics of classified earnings for the state. For the least representative of the industries, the number of wage-earners is nearly one-fifth of the total number employed in the industry. For many industries the proportion is a little less or a little more than one-half; for a few it is approximately three-fourths, and for one it is nearly seven-eighths. The average earnings of men employed in all industries in the state were $11.53. For 11 of the selected industries the averages were higher than the average for the state as a whole. The industry of greatest importance, measured by the number of men employed, was iron and steel, steel works and rolling mills, with steam railroad repair shops next, and foundry and machine shop products third. Earnings averaged highest, $14.93, in clothing, women's, and lowest, $8.61, in tobacco, cigars and cigarettes. The average earnings of all women in the state were $5.68. For 4 of the 27 selected industries women were not reported; for 14 of them the average earnings were greater than for the state as a whole. The largest numbers of women were reported for tobacco, cigars and cigarettes, silk and silk goods, and hosiery and knit goods. They earned $7.71, the highest average, in steam railroad repair shops, and lowest, $4.78, in bread and other bakery products. The average earnings of all children employed in the manufacturing industries of the state were $3.46. Of the selected industries, in 1 the average was the same as for the state; in 17 industries it was higher, the highest, $5.68, being reported for iron and steel, blast furnaces. The lowest average, $2.23, was reported for clothing, women's. The largest numbers of children were reported for silk and silk goods, hosiery and knit goods, and glass; in all but glass the average earnings were lower than the average for the state.

Northern South Atlantic division.—Among the industries in which this division had considerable prominence in the returns of value of products at the census of 1905 were shipbuilding, iron and steel; tobacco, cigars and cigarettes; leather, tanned, curried, and finished; and clothing, men's.

For the division as a whole there are included in these statistics more than one-half of the establishments employing wage-earners and over two-fifths of the greatest number of wage-earners employed at any one time.

TABLE 35.—*Northern South Atlantic division—number and per cent of establishments and wage-earners included in weekly earnings, by states: 1905.*

ESTABLISHMENTS AND WAGE-EARNERS.	Northern South Atlantic division.	Delaware.	Maryland.	District of Columbia.	Virginia.	West Virginia.
Establishments, total number	10,261	631	3,852	482	3,187	2,109
Reporting no wage-earners	729	27	333	72	156	141
Reporting wage-earners	9,532	604	3,519	410	3,031	1,968
Included in weekly earnings	5,646	380	2,283	276	1,481	1,226
Per cent	59.2	62.9	64.9	67.3	48.9	62.3
Wage-earners, greatest number	348,430	29,405	138,375	8,010	112,775	59,865
Included in weekly earnings	148,013	15,783	65,601	4,836	34,233	27,560
Per cent	42.5	53.7	47.4	60.4	30.4	46.0

The District of Columbia leads, both in proportion of its establishments and of its wage-earners, having in the former over two-thirds and in the latter over three-fifths. The state represented by the least proportion of both its establishments and its wage-earners is Virginia, although nearly one-half of the former are included and almost one-third of the latter.

The largest proportion of wage-earners in the division was in Maryland, 44.3 per cent; the least, in the District of Columbia, 3.3 per cent. The divisional proportion for Virginia was next to that for Maryland; West Virginia was third, and Delaware fourth.

The average earnings of all wage-earners in Delaware, the District of Columbia, and West Virginia were higher than for the division. Maryland and Virginia reported a lower average. In the District of Columbia the average was the highest and in Virginia it was the lowest.

TABLE 36.—NORTHERN SOUTH ATLANTIC DIVISION—NUMBER AND PER CENT OF WAGE-EARNERS AT EACH AMOUNT OF CLASSIFIED EARNINGS, BY STATES: 1905.

WEEKLY EARNINGS.	NORTHERN SOUTH ATLANTIC DIVISION.		DELAWARE.		MARYLAND.		DISTRICT OF COLUMBIA.		VIRGINIA.		WEST VIRGINIA.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Total	148,013	100.0	15,783	100.0	65,601	100.0	4,836	100.0	34,233	100.0	27,560	100.0
Less than $3	12,086	8.2	678	4.3	6,059	9.2	221	4.6	3,804	11.1	1,324	4.8
$3 to $4	10,157	6.9	816	5.2	5,626	8.6	240	5.0	2,459	7.2	1,016	3.7
$4 to $5	10,831	7.3	916	5.8	5,942	9.1	178	3.7	2,669	7.8	1,126	4.1
$5 to $6	10,473	7.1	1,316	8.3	4,770	7.3	178	3.7	3,199	9.3	1,010	3.7
$6 to $7	15,630	10.5	1,545	9.8	6,030	9.2	381	7.9	5,771	16.9	1,903	6.9
$7 to $8	14,458	9.8	1,262	8.0	6,237	9.5	291	6.0	4,393	12.8	2,275	8.3
$8 to $9	11,996	8.1	1,691	10.7	4,946	7.5	233	4.8	2,411	7.0	2,715	9.8
$9 to $10	13,796	9.3	1,096	6.9	5,285	8.1	597	12.3	2,309	6.7	4,509	16.4
$10 to $12	14,943	10.1	2,328	14.8	6,382	9.7	593	12.2	2,086	6.1	3,553	12.9
$12 to $15	14,824	10.0	1,873	11.9	6,510	9.9	725	15.0	2,346	6.9	3,370	12.2
$15 to $20	12,856	8.7	1,931	12.2	5,247	8.0	742	15.3	2,014	5.9	2,922	10.6
$20 to $25	3,514	2.4	250	1.6	1,635	2.5	303	6.3	430	1.3	896	3.2
$25 and over	2,449	1.6	81	0.5	931	1.4	154	3.2	342	1.0	941	3.4
Earnings for the specified week:												
Total	$1,317,757		$146,350		$564,123		$53,965		$263,262		$290,057	
Average per wage-earner	$8.90		$9.27		$8.60		$11.16		$7.69		$10.52	

While there was no industry in the division that had great weight upon the totals for the United States, several were prominent, namely, leather, tanned, curried, and finished; shipbuilding, iron and steel; tobacco, cigars and cigarettes; clothing, men's; and shirts.

The proportion that men formed of all wage-earners in this group of states was higher than that for the other group of states in the South Atlantic division, or for either of the minor divisions of the North Atlantic division, but it was much lower than in 7 other minor divisions of the United States. The division was higher in proportion of women than the Southern South Atlantic, and higher in children than any other except the Southern South Atlantic and Eastern South Central divisions. In Maryland the proportion of men was lowest, accompanied by the largest proportion of both women and children. The state having the greatest proportion of men—one that ranks well with some of the extreme Western states—was West Virginia; this state was least in the percentage of women, but the District of Columbia was a little below it in percentage of children.

About one-half of the wage-earners in the division were employed in establishments averaging 150 or more wage-earners annually. This result was due largely to conditions in Delaware; considerably over one-third of the wage-earners included for that state were returned from establishments having 500 wage-earners and over. There were no wage-earners in the District of Columbia in establishments of that class, and less than one-fifth in establishments having an annual average of from 300 to 500. The District reported the least proportion of wage-earners in the larger factories.

TABLE 37.—*Northern South Atlantic division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905.*

[Size of establishments determined by the average number of wage-earners employed during the year.]

STATE.	Number of wage-earners.	PER CENT IN EACH CLASS OF ESTABLISHMENTS.					
		Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
	ALL WAGE-EARNERS.						
Northern South Atlantic division	148,013	12.7	16.7	20.9	14.5	10.1	25.1
Delaware	15,783	7.6	12.0	19.7	18.0	5.4	37.3
Maryland	65,601	11.1	16.9	19.6	16.3	8.7	27.4
District of Columbia	4,836	18.0	37.8	24.8	....	19.4	....
Virginia	34,233	15.8	13.5	22.9	11.7	10.3	25.8
West Virginia	27,560	15.1	19.1	21.3	14.0	14.2	16.3
	MEN 16 YEARS AND OVER.						
Northern South Atlantic division	117,968	14.3	17.6	20.4	13.0	9.7	25.0
Delaware	13,544	8.0	11.3	17.4	17.1	6.2	40.0
Maryland	46,082	13.6	19.2	19.2	13.7	7.2	27.1
District of Columbia	4,341	16.8	35.4	26.7	....	21.1	....
Virginia	28,544	17.5	14.0	22.1	10.7	10.0	25.7
West Virginia	25,457	15.1	18.9	21.2	14.1	13.8	16.9
	WOMEN 16 YEARS AND OVER.						
Northern South Atlantic division	24,921	5.5	13.1	23.8	20.6	11.9	25.1
Delaware	1,874	4.7	15.7	35.9	26.9	....	16.8
Maryland	16,425	4.2	11.5	22.1	22.5	12.0	27.7
District of Columbia	431	24.6	61.2	9.3	....	4.9	....
Virginia	4,573	5.6	10.0	28.0	15.4	12.6	28.4
West Virginia	1,618	13.5	22.4	18.8	15.1	23.9	6.3
	CHILDREN UNDER 16 YEARS.						
Northern South Atlantic division	5,124	11.6	14.5	17.0	19.2	10.2	27.5
Delaware	365	5.7	19.7	23.3	5.5	....	45.8
Maryland	3,094	9.3	12.0	12.9	22.6	12.8	30.4
District of Columbia	64	50.0	46.9	3.1	....	....	....
Virginia	1,116	13.2	15.8	21.3	20.8	9.7	19.2
West Virginia	485	22.3	19.2	30.7	6.2	3.7	17.9

A smaller proportion of men than of women or children were reported by establishments employing 150 or more annually. As of all wage-earners, so of men, Delaware had the largest and the District of Columbia the smallest proportion in the larger establishments. In Maryland a greater proportion of women and children than in any other state was in the larger factories, but the District of Columbia had very few women and no children in them. Exactly 50 per cent of the children wage-earners in the District of Columbia were in establishments employing annually less than 10 wage-earners, and 46.9 per cent in those employing from 10 to 50. Of the states reporting children in the larger factories, West Virginia had the least proportion—a little over one-fourth.

Only Maryland and Virginia are presented by principal industries in Table 72. The average earnings of men in Maryland were $10.27. The selected industry for which the largest number of men was reported was steam railroad repair shops; the average earnings in this were $12.48—much higher than for the state. The highest average, $13.45, was returned for women's clothing. Women in this state earned an average of $4.99. They were most largely reported in the manufacture of shirts, in which industry their average was $4.70. The highest average, $7.14, was earned in steam railroad repair shops, in which the number was few; the lowest, $4.25, in tinware. The average earnings of children were $2.87. The largest number was reported for canning and preserving fruits and vegetables, the average earnings in which were $3.08. Iron and steel shipbuilding reported the highest average earnings, $5.53, and shirts the lowest, $2.20.

The returns for 9 of the leading industries in Virginia include over one-third of the greatest number of wage-earners employed in all establishments in the state in the same industries. The average earnings of men for the state were $8.47. Two of the selected industries returned higher average earnings, namely, steam railroad repair shops and foundry and machine shop products. The highest average earnings, $11.04, were returned for steam railroad repair shops, and the lowest, $5.97, for tobacco, chewing and smoking, and snuff. The industry having the greatest effect upon the totals, because of the largest number of men employed, was steam railroad repair shops; the next was lumber and timber products, in which industry the average earnings were $6.74. Women were more highly paid in the selected industries than in the state at large. Their average for 9 industries shown was $4.20, while for the state it was $3.95. Average earnings were highest, $6.50, in steam railroad repair shops, and lowest, $3.74, in tobacco, chewing and smoking, and snuff. The industry having the greatest effect upon the general averages, because employing the largest number of women, was tobacco, cigars and cigarettes, for which the average was $4.35. For children, in all the industries shown for the state, the average earnings were $3.05. The highest average among the selected industries was $5, reported for steam railroad repair shops, and the lowest, $2.04, for planing mills. The largest employment of children was in the manufacture of tobacco, cigars and cigarettes, and in this their earnings averaged $3.95.

The average earnings of men for Delaware were $10; of women, $5.13; and of children, $3.67. The industries for which the largest numbers of men were returned were leather, tanned, curried, and finished, and foundry and machine shop products; earnings in these averaged $9.79 and $11.01, respectively. Other prominent industries were steel works and rolling mills; shipbuilding, iron and steel; steam railroad repair shops; and cars, steam railroad. The highest average was $16.71, earned in paints; the lowest, $5.37, shown for fertilizers. Women and children were most numerous in leather, tanned, curried, and finished. Their earnings in this industry averaged $5.75 and $5.03. Women earned the highest average, $8, in the manu-

facture of patent medicines and compounds; the lowest, $2.76, in boxes, wooden packing. Children earned the highest average, $5.03, in leather, tanned, curried, and finished; the lowest, $2, in boxes, wooden packing; carriages and wagons; and coppersmithing and sheet iron working.

For the District of Columbia the earnings of men averaged $11.87; of women, $5.12; and of children, $3.56. These statistics do not include governmental establishments. More men were reported for steam railroad repair shops than for any other industry, but as the establishments number less than 3, operations might be disclosed if averages were mentioned. For gas, illuminating and heating, the next highest number was reported; these figures are also for less than 3 establishments. Printing and publishing, book and job, was the leading industry, both for men and women, among industries having 3 establishments or more. The average earnings were $11.57 for men and $6.21 for women. For men the highest average, $16.85, was earned in printing and publishing, newspapers and periodicals; for women, $10, in hand stamps; for children, $6, in carriages and wagons. For men the lowest average, $8.03, was earned in pottery, terra cotta, and fire clay products; for women, $4, in mineral and soda waters; for children, $1, in tobacco, cigars and cigarettes.

West Virginia returned earnings averaging $11 for men, $5.12 for women, and $3.67 for children. Men were most largely employed in lumber and timber products, their earnings averaging $9.18; and next most largely in steam railroad repair shops, in which their average earnings were $10.73. Other industries in which they were employed in large numbers were steel works and rolling mills, coke, and glass, the average earnings being $14.24, $9.31, and $15.88. Women were reported to be employed in the greatest numbers in the manufacture of cigars and cigarettes; their average earnings in this industry were $5.76. Children's earnings averaged $3.41 in the glass industry, for which they were most numerously returned. The highest average earnings for men were $15.88, returned for glass; the lowest, $7.17, for patent medicines and compounds. The highest average earnings for women were $8.33, returned for steam railroad repair shops; the lowest, $2.67, for furniture. For children the highest average earnings were $6, in the manufacture of pottery, terra cotta, and fire clay products; the lowest, $1.50, in the manufacture of woolen goods.

Southern South Atlantic division.—The industrial development of this division has been so marked that at the census of 1905 it produced in value more than 30 per cent of the fertilizers manufactured in the United States, about 30 per cent of the cotton goods, and over 20 per cent of the chewing and smoking tobacco and snuff. The value of furniture, lumber and timber products, and tobacco, cigars and cigarettes, manufactured was also considerable.

TABLE **38.**—*Southern South Atlantic division—number and per cent of establishments and wage-earners included in weekly earnings, by states: 1905.*

ESTABLISHMENTS AND WAGE-EARNERS.	Southern South Atlantic division.	North Carolina.	South Carolina.	Georgia.	Florida.
Establishments, total number	9,303	3,272	1,399	3,219	1,413
Reporting no wage-earners	348	110	31	130	77
Reporting wage-earners	8,955	3,162	1,368	3,089	1,336
Included in weekly earnings	4,535	1,698	791	1,520	526
Per cent	50.6	53.7	57.8	49.2	39.4
Wage-earners, greatest number	366,733	112,185	76,002	121,413	57,133
Included in weekly earnings	145,984	51,240	32,424	46,932	15,388
Per cent	39.8	45.7	42.7	38.7	26.9

Over one-half of the establishments in which wage-earners were employed are included in the statistics of classified weekly earnings. The state most largely represented is South Carolina; the one least represented is Florida. Of the total greatest number of wage-earners reported at the census of 1905, as in this division, nearly 40 per cent are included in these statistics. North Carolina reports the largest proportion, and Florida the least.

TABLE **39.**—SOUTHERN SOUTH ATLANTIC DIVISION—NUMBER AND PER CENT OF WAGE-EARNERS AT EACH AMOUNT OF CLASSIFIED EARNINGS, BY STATES: 1905.

WEEKLY EARNINGS.	SOUTHERN SOUTH ATLANTIC DIVISION.		NORTH CAROLINA.		SOUTH CAROLINA.		GEORGIA.		FLORIDA.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Total	145,984	100.0	51,240	100.0	32,424	100.0	46,932	100.0	15,388	100.0
Less than $3	25,935	17.8	10,726	20.9	7,782	24.0	6,540	13.9	887	5.8
$3 to $4	21,016	14.4	9,063	17.7	5,968	18.4	5,111	10.9	874	5.7
$4 to $5	25,338	17.4	9,926	19.4	6,702	20.7	7,350	15.7	1,360	8.8
$5 to $6	20,399	14.0	6,358	12.4	4,407	13.6	8,191	17.4	1,443	9.4
$6 to $7	19,240	13.2	6,718	13.1	3,125	9.6	7,395	15.8	2,002	13.0
$7 to $8	9,963	6.8	3,075	6.0	1,371	4.2	3,426	7.3	2,091	13.6
$8 to $9	5,190	3.5	1,465	2.8	948	2.9	1,993	4.2	784	5.1
$9 to $10	4,529	3.1	1,333	2.6	839	2.6	1,645	3.5	712	4.6
$10 to $12	4,257	2.9	956	1.9	418	1.3	1,512	3.2	1,371	8.9
$12 to $15	4,516	3.1	778	1.5	388	1.2	1,681	3.6	1,669	10.8
$15 to $20	3,973	2.7	649	1.3	336	1.0	1,422	3.0	1,566	10.2
$20 to $25	1,062	0.7	141	0.3	112	0.4	451	1.0	358	2.3
$25 and over	566	0.4	52	0.1	28	0.1	215	0.5	271	1.8
Earnings for the specified week:										
Total	$831,064		$254,059		$151,687		$286,187		$139,131	
Average per wage-earner	$5.69		$4.96		$4.68		$6.10		$9.04	

Of the total number of wage-earners in the division, 35.1 per cent, the greatest proportion, were returned from North Carolina, and the least, 10.5 per cent, from Florida.

Florida led with the highest average earnings, which were nearly double those for South Carolina, which were the lowest.

Nearly three-fourths of the wage-earners in the division were men. The proportion of women, 16 per cent, while not so large as in 3 other divisions, is noticeable. The proportion of children, 11.8 per cent, was very much larger than that shown for any other division. Florida returned the largest percentage of men and the smallest of women and children. South Carolina returned the smallest proportion of men and the largest of children. North Carolina reported the largest proportion of women, with South Carolina a close second.

By far the most important industry in this division, measured by the number of wage-earners returned, was cotton goods, reporting 39.7 per cent of the number of wage-earners returned for this industry in the United States and included in these statistics. The next was lumber and timber products, followed by tobacco, cigars and cigarettes.

TABLE 40.—*Southern South Atlantic division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905.*

[Size of establishments determined by the average number of wage-earners employed during the year.]

STATE.	Number of wage-earners.	PER CENT IN EACH CLASS OF ESTABLISHMENTS.					
		Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
	ALL WAGE-EARNERS.						
Southern South Atlantic division	145,984	11.9	17.5	20.6	20.6	12.2	17.2
North Carolina	51,240	13.4	12.6	21.5	21.3	13.5	17.7
South Carolina	32,424	10.4	10.6	15.1	19.4	16.4	28.1
Georgia	46,932	11.9	24.8	23.3	21.3	7.3	11.4
Florida	15,388	9.7	25.8	20.8	18.7	14.6	10.4
	MEN 16 YEARS AND OVER.						
Southern South Atlantic division	105,415	15.5	21.8	20.6	18.3	10.6	13.2
North Carolina	33,283	19.5	16.2	20.3	16.7	12.8	14.5
South Carolina	20,353	15.7	14.5	18.6	15.9	13.8	21.5
Georgia	37,995	13.8	29.0	22.2	21.1	5.7	8.2
Florida	13,784	9.8	26.2	20.5	18.1	13.8	11.6
	WOMEN 16 YEARS AND OVER.						
Southern South Atlantic division	23,390	2.2	6.7	21.5	25.8	17.6	26.2
North Carolina	10,397	1.6	5.8	24.5	29.5	15.7	22.9
South Carolina	6,406	1.3	4.4	8.7	25.0	22.7	37.9
Georgia	5,129	3.4	7.9	30.4	19.1	13.5	25.7
Florida	1,458	5.2	19.8	24.6	26.9	23.5	....
	CHILDREN UNDER 16 YEARS.						
Southern South Atlantic division	17,179	3.0	5.7	19.1	27.6	15.2	29.4
North Carolina	7,560	2.6	6.6	23.2	30.2	13.3	24.1
South Carolina	5,665	1.6	3.5	9.6	25.6	18.8	40.9
Georgia	3,808	4.5	5.6	25.2	26.8	14.0	23.9
Florida	146	44.5	46.6	8.9	....	....	....

It is noticeable that exactly one-half of all the wage-earners in the division were employed in establishments having an annual average of 150 or more wage-earners.

The proportion was largest in South Carolina and least in Georgia, although the percentage in Florida was not much greater. The proportion of all wage-earners employed in factories of this size in North Carolina was only a little more than 50 per cent. The proportion of men employed in these larger factories, both for the division and states, is much less than the proportion of women or of children except in Florida. Of the men, only about 42 per cent worked in factories employing an annual average of 150 or more wage-earners, while this was true of nearly 70 per cent of the women and of nearly three-fourths of the children. Of the men in the larger factories, South Carolina had the greatest proportion, something over one-half, and Georgia the least proportion, with exactly 35 per cent. Of the women, South Carolina had almost seven-eighths. Florida was last, with about one-half. No children were employed in this state in establishments of the larger size, and only 8.9 per cent in factories employing an average of from 50 to 150 wage-earners annually. In South Carolina nearly seven-eighths of the children, or substantially the same proportion as of the women, were returned by the larger factories.

For all industries in North Carolina the average earnings for men were $5.92. In 3 of the selected industries the average earnings were higher than for the state. The highest average, $10.15, is shown for steam railroad repair shops; the lowest, $5.20, for tobacco, chewing and smoking, and snuff. The industry for which the largest number of men was reported was cotton goods, in which the average earnings were $5.33. Lumber and timber products returned almost as many men. The average earnings of women for the state were $3.60. In 3 of the selected industries no women were reported. In 1 industry only was the average higher than for either the state or the total of the selected industries; this was cotton goods, in which women averaged $3.82, and this was their highest average; the least, $2.50, was returned for lumber and timber products. The largest number of women was reported for cotton goods; the next largest number for tobacco, chewing and smoking, and snuff. In the latter industry the average earnings were $2.64. Average earnings for children, $2.58, were exactly alike for the state and for the selected industries. In 4 industries the average was higher than for either the state or the selected industries. The highest, $3.25, was returned for steam railroad repair shops, but the representation was so small as to be substantially without effect upon the general average. Most of the children were employed in cotton factories, in which their earnings averaged $2.64. A large number was also employed in the manufacture of chewing and smoking tobacco and snuff, the average earnings being $2.33. The least earnings on the average, $2.22, were returned for planing mills.

Six of the leading industries in South Carolina had 86.3 per cent of the number of wage-earners returned on the schedules selected to illustrate classified earnings. The average earnings for men were $5.47 for the state and $5.33 for the selected industries. The highest average, $10.62, was earned in steam railroad repair shops, and the lowest, $4.74, in the manufacture of lumber and timber products. The greatest number of men returned was by the cotton goods industry, which had therefore the largest single effect upon the result. The average earnings in this industry, $5.15, were only a little below the average for the selected industries. The average earnings of women for the state were $3.84, and only 1 cent less for the selected industries. In hosiery and knit goods, their earnings averaged $3.90. The lowest earnings, $3.38, are shown for steam railroad repair shops. The industry of most importance in its effect upon the earnings in the state was that of cotton goods, nearly 90 per cent of the women wage-earners reported for the state being employed in it. The average earnings were $3.83, which is 1 cent below that of the average for the state. On an average, children earned in the state $2.79, and in the selected industries $2.80, which latter average is exactly that for cotton goods, which dominates, having almost the entire number of children, both for the state and selected industries. The highest average earnings were in this industry; the least average earnings, $2.42, were reported for lumber and timber products, but the number employed was small.

The 10 leading industries for Georgia represent 76.3 per cent of the greatest number shown for the state in these statistics. In nearly every industry a considerable proportion of the greatest number employed at any one time is represented. Average earnings of men in the state were $6.70, and in the 10 selected industries, $6.43. Steam railroad repair shops reported the highest average, $10.39, and oil, cottonseed and cake, the lowest, $5.29. In only 4 industries were average earnings higher than in general. The industry returning the largest number of men was lumber and timber products. The average earnings in that industry were $6.05. The industry having the next largest number of men was cotton goods, in which the average earnings were $5.82. Average earnings of women for the state were $4.24, and for the selected industries, $4.18. These averages were exceeded by only 1 industry, that of hosiery and knit goods, in which they were $4.66. Women predominated in cotton goods, constituting more than one-half of the women wage-earners returned for the state, and nearly the whole number of those shown for the selected industries. Their average earnings were $4.17. The highest average, $4.66, was in hosiery and knit goods; the lowest, $1.30, in furniture. Children's earnings were $2.59 on an average in the state and $2.62 in the selected industries. These figures were most strongly affected by the children employed in the manufacture of cotton goods, who constituted over seven-eighths of the number returned in the selected industries and more than three-fourths of those returned for the state. Their average earnings were $2.62, exactly the average for the selected industries. Foundry and machine shops reported the highest average, $3; the least average, $2.31, was reported for planing mills, but the number returned was small.

Of the 1,413 establishments reported for Florida at the census of 1905, 77 employed no wage-earners; of the remaining 1,336, 526, or 39.4 per cent, are included in the returns of classified earnings. The greatest number of wage-earners employed at any one time was 57,133; the total in classified earnings is 15,388, or 26.9 per cent. Florida is not one of the 25 states for which selected industries are presented in Table 72. The average earnings of men were $9.37; of women, $6.55; and of children, $2.66. The leading industry according to the number of men, and also of women and children, was tobacco, cigars and cigarettes. Of men, 4,926, or 35.7 per cent of the total number shown for all the industries, were reported; of women, 1,316, or 90.3 per cent; and of children, 23, or 15.8 per cent. The average earnings of the men were $13.56; of the women, $6.70; and of the children, $2.65. An industry peculiar to the South was turpentine and rosin, for which were returned 2,914 men, or 21.1 per cent of the whole number shown for the state. The average earnings of the men were $4.98. Another was fertilizers, in which the average earnings of men were $6.72; and still another, oil, cottonseed and cake, in which they were $6.53. The highest average for men, $15.91, was earned in the coppersmithing and sheet iron industry; the lowest, $4, in patent medicines and compounds. For women the highest average, $10, was earned in confectionery; the lowest, $2, in mineral and soda waters. For children the highest, $5, was earned in confectionery; the lowest, $1.50, in mattresses and spring beds.

Eastern North Central division.—At the census of 1905 this division returned more than one-half of the value of products of the entire United States, for agricultural implements; automobiles; cash registers and calculating machines; liquors, distilled; oleomargarine; refrigerators; and stoves and furnaces; and also nearly one-half of the value of carriages and wagons; cars, steam railroad; food preparations; furniture; linseed oil; and slaughtering and meat packing, wholesale. Every state in the division is entitled to prominent mention for the number of wage-earners employed, the average during the year being 379,436 for Illinois, 364,298 for Ohio, 175,229 for Michigan, 154,174 for Indiana, and 151,391 for Wisconsin.

The test of the representative character of the returns, included in these statistics of average weekly earnings, is best made by a comparison of the number shown for the selected week with the greatest number employed at any one time during the year.

TABLE 41.—*Eastern North Central division—number and per cent of establishments and wage-earners included in weekly earnings, by states: 1905.*

ESTABLISHMENTS AND WAGE-EARNERS.	Eastern North Central division.	Ohio.	Indiana.	Illinois.	Michigan.	Wisconsin.
Establishments, total number	51,754	13,785	7,044	14,921	7,446	8,558
Reporting no wage-earners	5,370	1,203	528	1,825	686	1,128
Reporting wage-earners	46,384	12,582	6,516	13,096	6,760	7,430
Included in weekly earnings	30,477	8,328	4,678	8,382	4,303	4,786
Per cent	65.7	66.2	71.8	64.0	63.7	64.4
Wage-earners, greatest number	1,589,196	457,467	205,419	478,488	242,806	205,016
Included in weekly earnings	785,058	245,944	124,607	224,664	120,978	68,865
Per cent	49.4	53.8	60.7	47.0	49.8	33.6

The comparison for the division indicates that nearly two-thirds of the establishments reporting wage-earners and about one-half of the greatest number of wage-earners are represented. For the establishments and wage-earners of Indiana and of Ohio more than these proportions are shown. For Wisconsin the representation of wage-earners is the smallest; for establishments this is true of Michigan, but not in such marked disproportion. Of all wage-earners shown for the division, Ohio has 31.3 per cent, which is the greatest proportion, and Wisconsin 8.8 per cent, the least.

The group of earnings in which the median is located is $9 to $10 for the division and for each of the states, except Illinois, where 58.8 per cent of all wage-earners received at least $10.

TABLE 42.—EASTERN NORTH CENTRAL DIVISION—NUMBER AND PER CENT OF WAGE-EARNERS AT EACH AMOUNT OF CLASSIFIED EARNINGS, BY STATES: 1905.

WEEKLY EARNINGS.	EASTERN NORTH CENTRAL DIVISION.		OHIO.		INDIANA.		ILLINOIS.		MICHIGAN.		WISCONSIN.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Total	785,058	100.0	245,944	100.0	124,607	100.0	224,664	100.0	120,978	100.0	68,865	100.0
Less than $3	21,699	2.8	7,330	3.0	5,207	4.2	5,161	2.3	2,491	2.1	1,510	2.2
$3 to $4	28,124	3.6	9,966	4.0	5,400	4.3	5,781	2.6	4,459	3.7	2,518	3.7
$4 to $5	35,556	4.5	12,297	5.0	6,327	5.1	8,346	3.7	5,485	4.5	3,101	4.5
$5 to $6	36,160	4.6	12,773	5.2	6,192	5.0	9,494	4.2	4,914	4.1	2,787	4.0
$6 to $7	43,445	5.5	13,438	5.5	7,936	6.4	11,413	5.1	7,005	5.8	3,653	5.3
$7 to $8	51,338	6.5	16,256	6.6	10,299	8.3	12,674	5.6	7,261	6.0	4,848	7.0
$8 to $9	62,140	7.9	19,898	8.1	11,601	9.3	14,531	6.4	9,786	8.1	6,324	9.2
$9 to $10	115,442	14.7	33,163	13.5	18,709	15.0	25,384	11.3	26,545	21.9	11,641	16.9
$10 to $12	124,867	15.9	36,490	14.8	16,413	13.2	38,798	17.3	20,596	17.0	12,570	18.3
$12 to $15	128,107	16.3	40,815	16.6	17,119	13.7	40,843	18.2	18,530	15.3	10,800	15.7
$15 to $20	101,219	12.9	31,793	12.9	13,232	10.6	37,928	16.9	11,187	9.2	7,079	10.3
$20 to $25	24,670	3.2	7,275	3.0	3,894	3.1	10,062	4.5	1,896	1.6	1,543	2.2
$25 and over	12,291	1.6	4,450	1.8	2,278	1.8	4,249	1.9	823	0.7	491	0.7
Earnings for the specified week:												
Total	$8,366,133		$2,614,720		$1,257,958		$2,595,822		$1,200,496		[illegible]7,137	
Average per wage-earner	$10.66		$10.63		$10.10		$11.55		$9.92		$10.12	

The average earnings did not coincide with these groups except in Illinois and Michigan, although for the other states the differences were not great. The average for Illinois was the highest, and much higher than for the division as a whole; for Michigan it was the lowest. The average earnings of men and women were greatest in Illinois. For men they were least in Wisconsin, although the average was not much below that for Michigan or Indiana. The lowest average earned by women was in Indiana. The averages for children were remarkably even; Indiana led by a few cents and Wisconsin was last.

Considerably over four-fifths of the wage-earners were men, the women constituting a little more than one-ninth, and the children about one-seventieth. Wisconsin reported the greatest proportion of men and children, and Michigan the greatest proportion of women. Michigan had the least proportion of men; Wisconsin, of women; and Ohio, of children.

The returns for this division have more influence upon the statistics of earnings for the United States in many of the nontextile industries than those of any other division except the Southern North Atlantic; 23.8 per cent of all wage-earners, in all industries in the United States, are included in its classified weekly earnings. Among the industries in which the percentage of wage-earners of the total for the United States is large are—agricultural implements, 70.6 per cent; furniture, 44.3 per cent; carriages and wagons, 43.4 per cent; iron and steel, steel works and rolling mills, 42.9 per cent; pottery, terra cotta, and fire clay products, 33.4 per cent; foundry and machine shop products, 33.2 per cent. Other industries, for which a considerable proportion of the total for the United States is shown, are—printing and publishing, book and job, 27.4 per cent; lumber, planing mill products, including sash, doors, and blinds, 25.1 per cent; printing and publishing, newspapers and periodicals, 22.9 per cent; lumber and timber products, 21.6 per cent.

TABLE 43.—*Eastern North Central division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905.*

[Size of establishments determined by the average number of wage-earners employed during the year.]

STATE.	Number of wage-earners.	PER CENT IN EACH CLASS OF ESTABLISHMENTS.					
		Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
	ALL WAGE-EARNERS.						
Eastern North Central division	785,058	11.8	15.8	19.9	15.4	11.2	25.9
Ohio	245,944	10.4	15.6	20.1	14.7	13.6	25.6
Indiana	124,607	12.9	17.2	21.3	15.1	11.2	22.3
Illinois	224,664	11.5	13.0	18.2	15.5	8.7	33.1
Michigan	120,978	10.9	21.3	23.7	16.2	11.3	16.6
Wisconsin	68,865	17.4	13.2	16.2	16.4	11.0	25.8
	MEN 16 YEARS AND OVER.						
Eastern North Central division	680,238	11.7	15.0	19.2	15.0	11.5	27.6
Ohio	211,989	10.3	14.9	20.0	14.5	13.5	26.8
Indiana	108,854	13.1	16.3	20.2	14.0	12.2	24.2
Illinois	194,782	11.2	12.4	17.0	15.0	9.1	35.3
Michigan	102,936	10.7	20.6	23.0	16.4	11.4	17.9
Wisconsin	61,677	17.2	11.8	15.4	16.2	11.4	28.0
	WOMEN 16 YEARS AND OVER.						
Eastern North Central division	93,626	12.2	21.1	24.8	17.7	9.5	14.7
Ohio	30,989	11.0	20.1	20.8	16.1	14.5	17.5
Indiana	13,650	11.4	24.0	29.3	23.0	3.9	8.4
Illinois	27,001	12.6	16.4	25.6	18.9	6.2	20.3
Michigan	16,405	11.9	25.7	27.5	14.5	11.1	9.3
Wisconsin	5,581	20.9	29.0	23.6	15.8	6.4	4.3
	CHILDREN UNDER 16 YEARS.						
Eastern North Central division	11,194	15.3	16.0	22.0	19.5	10.3	16.9
Ohio	2,966	13.3	12.9	14.1	15.0	14.7	30.0
Indiana	2,103	13.4	17.5	27.0	22.1	8.5	11.5
Illinois	2,881	19.2	17.8	25.4	18.4	8.2	11.0
Michigan	1,637	15.0	18.6	26.6	22.7	5.8	11.3
Wisconsin	1,607	14.6	14.0	19.0	23.6	12.9	15.9

While in this division more than one-half of all wage-earners were employed in factories reporting an annual average of 150 or more, the percentage in estabments of this size is not so marked as in some of the other prominent manufacturing sections.

Only 52.5 per cent of all wage-earners in the division were in establishments of the larger size. In New England and in the Southern North Atlantic division the corresponding percentages were 64 and 54.8. Of the states in this division, Illinois had the greatest percentage in the larger factories and Michigan the least. This order also holds true for men wage-earners, but Ohio had the greatest percentage of women and of children in the larger factories, Wisconsin the least percentage of women, and Illinois of children.

Twenty-one industries are shown for Ohio in Table 72. For a number of them the proportion of wage-earners included ranges from less than two-thirds to almost three-fourths; and for many others the proportion is either a little above or a little below one-half. The average earnings of all men shown for the state were $11.49; in the selected industries they were $11.75, showing that the earnings in them were higher than in many of the industries not included. Foundry and machine shop products was the industry for which the greatest number of all wage-earners, and also of men, was reported, although steel works and rolling mills was not far behind. In the former industry the average earnings, although more for all wage-earners than the state average, were less for men, being $11.35. In steel works and rolling mills the men averaged $13.81. The highest average, $15.11, was returned for glass; the lowest, $8.93, for lumber and timber products. In 7 industries the average earnings of men were above the general average for the state. Earnings of women in the selected industries averaged $5.74, which was more than for the state. Women predominated in the manufacture of tobacco, cigars and cigarettes, an industry in which the average earnings were greater than the average in all. They were also numerous in boots and shoes, in which the average earnings were much higher. In 12 industries their earnings averaged higher than in general, steam railroad repair shops leading, with $8.40. Of all averages, the lowest was $3.37, reported for planing mills. Children's earnings were $3.61 on the average for the state. In 7 industries the earnings were higher than this, the first being steel works and rolling mills, with $5.40. More children were returned for boots and shoes than for any other industry; their average earnings were $3.25—less than the general average. The lowest average was $2.17, reported for lumber and timber products.

Only 2 of the 10 industries selected for Indiana represent less than one-half of the greatest number of wage-earners employed at any one time during the year. Some approach even seven-eighths of the greatest number, others three-fourths, and still others represent more than one-half. These industries include over one-half of the wage-earners considered for the state. Average earnings for men were $11.09, which is considerably larger than $10.88, the average for the state. Three industries have earnings considerably higher, the first being steel works and rolling mills, with $13.38. Lumber and timber products had the lowest average, $8.65. The industry for which men were reported in the largest number was steam railroad repair shops; that for which the next largest number was reported was foundry and machine shop products. Women's earnings on the average were returned as $4.47 in the selected industries; for the state they were $4.83. In 5 industries the earnings averaged higher than for the selected industries; in only 3 were they higher than the average for the state. In the printing and publishing of newspapers and periodicals women were most numerous, and their earnings in that industry were higher than the average for selected industries, but less than for the state. The highest average, $7.33, was shown for steam railroad repair shops; the lowest, $3.33, for

agricultural implements. The average earnings of children in the selected industries, $4.10, were much higher than for the state, and not far below those of women. The highest average, $4.68, was reported for glass, for which was returned the greatest number, and the lowest, $2.43, for the printing and publishing of newspapers and periodicals. In 2 industries the average was higher than for the selected manufac tures, and in 4 it was higher than for the state.

There are 20 industries of prominence in Illinois. The average earnings of men were $12.72 in the selected industries and a little less, $12.37, for the state. In 10 industries this average for the selected industries was exceeded, and in 13, average earnings were greater than for the state as a whole. In the manufacture of women's clothing the average was the highest, $17.90, but comparatively few men were employed. The average was lowest, $8.11, in lumber and timber products. More men were returned for foundry and machine shop products than for any other industry, and the average earnings in this were about on a level with those for the selected industries and higher than for the state. More women were reported for men's clothing than for any other industry; their average earnings were $6.73, compared with the general averages of $6.54 for the state and $6.59 for the selected industries. The lowest average was $3.86, in glass. The children were favored in the selected industries as a whole, for their average earnings were $3.79, compared with $3.58 for the state as a whole. In 10 industries the averages were greater than for all selected industries, and in 14, greater than for all the industries included for the state. The highest earnings, on the average, $5.40, were returned for malt liquors, but the number receiving this high amount was not representative; the lowest, $2.85, was for the printing and publishing of newspapers and periodicals. The largest number of children was returned for tobacco, cigars and cigarettes, and the next largest for printing and publishing, book and job.

The wage-earners in the establishments shown for the 13 leading industries in Michigan include about one-half of the number employed in all establishments returned for these industries in the state at the census of 1905. The average earnings of men were $10.78 for the state, and only a trifle less for the selected industries, the chief of which, measured by the number of men reported, was lumber and timber products. The average earnings returned for this industry were $10.30. The largest average, $12.22, was earned in the manufacture of stoves and furnaces, and the least, $8.95, in hosiery and knit goods. In 6 industries the earnings averaged higher than for all industries shown for the state. The number of women reported was greatest in hosiery and knit goods. Their earnings averaged $4.85, an amount less than for the selected industries, or the state, $5.20 and $5.17. In 7 industries the average was higher than in general. Carriages and wagons was the industry in which earnings were reported the highest, $6.64; in chemicals they were the lowest, $3.60. Children's average earnings were $3.66 for the state and $3.78 for the selected industries. The number reported for hosiery and knit goods was largest, but for furniture it was but 5 smaller. The earnings in the former industry averaged $3.17, and in the latter $4.23, so that the general average was quite largely determined by these manufactures. The industry in which children earned the highest average, $5.27, was stoves and furnaces; that in which they earned the lowest, $2.57, the printing and publishing of newspapers and periodicals.

The average earnings of men were $10.75 in all industries included for Wisconsin, and a little higher, or $10.81, for the selected industries given in Table 72, 6 of which showed greater average earnings than the general. The highest average, $11.86, was returned for malt liquors, and the lowest, $8.61, for furniture. While large numbers of men were reported for these industries, the chief industry, in numbers, was foundry and machine shop products, with lumber and timber products almost as great. Of the industries in which women were employed, 5 returned higher average earnings than the average for all the selected industries, $5.19, and 6 higher than for the state, $5.12. Earnings averaged highest, $8.33, in steam railroad repair shops, and least, $3.50, in lumber and planing mills. Nearly one-half of the women returned for the selected industries were employed in the manufacture of hosiery and knit goods; the average earnings were less than for either the total for the selected industries or for the state. The earnings in paper and wood pulp, and malt liquors, in which a considerable number of women were employed, were considerably higher and raised the general averages. Among the most important industries, measured by numbers, for which children were reported, hosiery and knit goods led, closely followed by furniture. In the textile industry named, earnings averaged $3.08, the least shown, while in the other industry, the average was $3.66. Earnings averaged greatest, $5.50, in paper and wood pulp.

Western North Central division.—This division was notable at the census of 1905 for having returned more than one-third of the total value of products for the United States in the flour and grist mill industry, a slightly larger proportion of the total for slaughtering and meat packing, and a slightly smaller proportion of the total for butter. The division includes 1 state that led the country in flour milling; 2 others that were respectively second and third in slaughtering and meat packing; and 1 that was fourth in boots and shoes, malt liquors, and slaughtering and meat packing.

TABLE 44.—WESTERN NORTH CENTRAL DIVISION—NUMBER AND PER CENT OF ESTABLISHMENTS AND WAGE-EARNERS INCLUDED IN WEEKLY EARNINGS, BY STATES: 1905.

ESTABLISHMENTS AND WAGE-EARNERS.	Western North Central division.	Minnesota.	Iowa.	Missouri.	North Dakota.	South Dakota.	Nebraska.	Kansas.
Establishments, total number	21,492	4,756	4,785	6,464	507	686	1,819	2,475
Reporting no wage-earners	2,552	533	521	754	64	76	321	283
Reporting wage-earners	18,940	4,223	4,264	5,710	443	610	1,498	2,192
Included in weekly earnings	13,084	2,779	2,947	3,836	306	445	1,094	1,677
Per cent	69.1	65.8	69.1	67.2	69.1	73.0	73.0	76.5
Wage-earners, greatest number	419,353	97,401	71,093	172,414	2,644	3,381	27,326	45,094
Included in weekly earnings	180,337	32,314	30,414	74,944	1,032	1,709	16,740	23,184
Per cent	43.0	33.2	42.8	43.5	39.0	50.5	61.3	51.4

Over two-thirds of the establishments reporting wage-earners at the census of 1905 and nearly one-half of the wage-earners reported are included in the discussion of weekly earnings.

The state leading in the proportion of establishments is Kansas and in wage-earners it is Nebraska. The state for which is included the least proportion of establishments, and of wage-earners also, is Minnesota. Of the wage-earners, Missouri has the largest number, or 41.6 per cent of the total, which is a little more than its proportion of the greatest number employed at any one time in the division as returned for all establishments at the census of 1905. North Dakota, with less than six-tenths of 1 per cent, has the least effect upon the totals.

TABLE 45.—WESTERN NORTH CENTRAL DIVISION—NUMBER AND PER CENT OF WAGE-EARNERS AT EACH AMOUNT OF CLASSIFIED EARNINGS, BY STATES: 1905.

WEEKLY EARNINGS.	WESTERN NORTH CENTRAL DIVISION.		MINNESOTA.		IOWA.		MISSOURI.		NORTH DAKOTA.		SOUTH DAKOTA.		NEBRASKA.		KANSAS.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Total	180,337	100.0	32,314	100.0	30,414	100.0	74,944	100.0	1,032	100.0	1,709	100.0	16,740	100.0	23,184	100.0
Less than $3	7,167	4.0	706	2.2	1,570	5.2	3,269	4.4	14	1.4	38	2.2	482	2.9	1,088	4.7
$3 to $4	7,062	3.9	1,119	3.5	1,399	4.6	3,151	4.2	20	1.9	33	1.9	485	2.9	855	3.7
$4 to $5	8,582	4.7	1,240	3.9	1,578	5.2	4,136	5.5	24	2.3	28	1.6	709	4.2	867	3.7
$5 to $6	8,414	4.7	1,295	4.0	1,380	4.5	4,099	5.5	49	4.7	53	3.1	744	4.4	794	3.4
$6 to $7	11,129	6.2	1,619	5.0	1,814	6.0	5,405	7.2	48	4.7	64	3.8	844	5.0	1,335	5.8
$7 to $8	11,189	6.2	1,557	4.8	2,105	6.9	5,291	7.1	63	6.1	58	3.4	744	4.4	1,371	5.9
$8 to $9	11,614	6.4	1,815	5.6	2,450	8.1	4,757	6.3	37	3.6	70	4.1	811	4.9	1,674	7.2
$9 to $10	20,481	11.3	3,456	10.7	4,490	14.8	7.793	10.4	90	8.7	192	11.2	1,558	9.3	2,902	12.5
$10 to $12	32,285	17.9	6,859	21.2	5,382	17.7	10,979	14.6	136	13.2	331	19.4	3,920	23.4	4,678	20.2
$12 to $15	30,685	17.0	6,530	20.2	4,331	14.2	11,958	15.9	262	25.4	438	25.6	3,410	20.4	3,756	16.2
$15 to $20	23,736	13.2	4,433	13.7	3,096	10.2	10,624	14.2	224	21.7	342	20.0	2,386	14.3	2,631	11.4
$20 to $25	5,537	3.1	1,263	3.9	652	2.1	2,296	3.1	51	4.9	54	3.2	493	3.0	728	3.1
$25 and over	2,456	1.4	422	1.3	167	0.5	1,186	1.6	14	1.4	8	0.5	154	0.9	505	2.2
Earnings for the specified week:																
Total	$1,888,367		$355,647		$294,232		$778,709		$12,193		$19,974		$182,300		$245,312	
Average per wage-earner	$10.47		$11.01		$9.67		$10.39		$11.81		$11.69		$10.89		$10.58	

In 5 of the 7 states the average weekly earnings of all wage-earners exceeded the average for the division, although in two instances by slight amounts.

The state for which the highest average was reported was North Dakota, South Dakota following it closely, and Iowa coming last. This division was higher than contiguous divisions in its proportion of women, Missouri showing the highest and Kansas the least. The largest proportion of men was employed in South Dakota and the least in Missouri. Less than 1 per cent of all the wage-earners reported for Minnesota were children, which was the smallest proportion for children in the various states of the division; Missouri had the largest proportion, or nearly 3 per cent.

The most important industry in the division, according to the number of wage-earners, was steam railroad repair shops. The next was slaughtering and meat packing, wholesale; and the third, foundry and machine shop products. Other industries having large numbers were lumber and timber products; flour and grist mill products; cars, steam railroad, not including operations of railroad companies; and boots and shoes.

TABLE 46.—*Western North Central division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905.*

[Size of establishments determined by the average number of wage-earners employed during the year.]

STATE.	Number of wage-earners.	PER CENT IN EACH CLASS OF ESTABLISHMENTS.					
		Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
	ALL WAGE-EARNERS.						
Western North Central division	180,337	21.9	16.8	18.1	14.8	10.4	18.0
Minnesota	32,314	24.7	12.3	16.9	17.6	15.0	13.5
Iowa	30,414	29.6	20.2	19.1	12.5	7.8	10.8
Missouri	74,944	15.8	18.0	19.7	16.3	11.4	18.8
North Dakota	1,032	73.2	12.1	14.7	...	...	...
South Dakota	1,709	70.4	22.1	7.5	...	...	...
Nebraska	16,740	20.1	11.6	10.9	15.1	6.2	36.1
Kansas	23,184	23.2	18.7	19.2	11.0	7.9	20.0
	MEN 16 YEARS AND OVER.						
Western North Central division	154,348	21.8	16.5	17.6	14.3	10.6	19.2
Minnesota	28,049	25.4	11.7	15.5	16.2	15.7	15.5
Iowa	26,132	28.9	20.3	17.1	13.1	8.4	12.2
Missouri	62,128	16.1	17.5	19.9	15.4	11.1	20.0
North Dakota	886	75.4	11.3	13.3	...	...	...
South Dakota	1,543	67.5	24.2	8.3	...	...	...
Nebraska	14,703	19.5	11.2	9.5	15.0	7.0	37.8
Kansas	20,907	21.2	18.5	20.2	11.4	8.8	19.9
	WOMEN 16 YEARS AND OVER.						
Western North Central division	22,037	21.5	19.1	22.5	18.7	9.6	8.6
Minnesota	4,079	18.8	15.2	26.9	28.4	10.5	0.2
Iowa	3,648	32.2	19.7	33.7	8.5	4.6	1.3
Missouri	10,617	13.3	20.8	19.2	20.8	14.2	11.7
North Dakota	124	56.5	16.1	27.4	...	...	...
South Dakota	140	97.1	2.9	...	...	...	...
Nebraska	1,653	23.7	15.8	22.0	18.5	...	20.0
Kansas	1,776	45.0	21.4	10.4	7.8	...	15.4
	CHILDREN UNDER 16 YEARS.						
Western North Central division	3,952	28.8	16.9	14.9	13.0	5.2	21.2
Minnesota	186	43.6	35.5	8.1	6.4	6.4	...
Iowa	634	43.7	18.9	19.1	9.9	...	8.4
Missouri	2,199	21.9	16.1	15.4	18.8	8.4	19.4
North Dakota	22	77.3	22.7	...	...	...	...
South Dakota	26	100.0	...	...	...	...	...
Nebraska	384	30.0	7.8	18.2	4.4	...	39.6
Kansas	501	28.5	19.0	8.6	1.4	1.6	40.9

A comparatively small proportion of wage-earners were employed in factories of the very largest size; more than 50 per cent of all wage-earners, and of men, and more than 60 per cent of women and children, were employed in establishments having a lower average than 150 wage-earners during the year.

Nebraska had 57.4 per cent of all wage-earners, and 59.8 per cent of all men returned from factories employing annually an average of 150 wage-earners or more. In North and South Dakota no wage-earners were employed in factories having 150 wage-earners; and all but 2.9 per cent of the women reported for South Dakota were employed in factories having less than 10.

Minnesota and Missouri are the only states in the division represented by selected industries in Table 72. Over one-third of the greatest number of wage-earners employed at any one time during the year in 10 leading industries in Minnesota are represented in the statistics. They constitute also nearly two-thirds of the wage-earners considered for the state in this report. The industry of flour and grist mill products, which according to value of products is the most important, and one in which the state leads the country, is represented by 58.8 per cent of its greatest number of wage-earners. Among the selected industries for the state, printing and publishing, book and job, reported the highest average earnings for men, $13.16, and furniture the lowest, $8.97. The average for the state was $11.75 and for the selected industries, $11.79. The industries having the greatest effect upon the general averages by reason of the large number of men reported were lumber and timber products, for which the earnings averaged $11.34, and steam railroad repair shops, for which the average was $11.90. Women earned on the average in the state $6.27, and in the selected industries, $7.07. The highest average of the selected industries, $8, was earned in foundry and machine shops, and the lowest, $3, in the manufacture of lumber and timber products. Of the selected industries, the one that returned the largest number of women was printing and publishing, newspapers and periodicals; earnings in this averaged $6.60, an amount a little more than that for the state at large, and considerably less than for the selected industries as a whole. Earnings for children averaged highest, $3.88, in planing mills, compared with $3.39 for the state and $3.14 for the selected industries. The lowest earnings, $2.78, were returned for tobacco, cigars and cigarettes. The largest number of children was reported for printing and publishing, newspapers and periodicals, and in this industry their average earnings were $3.08.

The average earnings of men in Iowa were $10.48; of women, $4.95; of children, $3.44. The industry in which the largest number of men was employed was steam railroad repair shops, for which nearly 18 per cent of all men included in these statistics for the state was reported. The earnings averaged $11.69. Other leading industries were foundry and machine shop products; printing and publishing, newspapers and periodicals; brick and tile; slaughtering and meat packing, wholesale; and lumber, planing mill products, including sash, doors, and blinds. The greatest number of women was returned for printing and publishing, newspapers and periodicals; their average earnings were $5.12. Additional leading industries, according to the number of women reported, were—buttons; clothing, men's; tobacco, cigars and cigarettes; pickles, preserves, and sauces; and canning and preserving, fruits and vegetables. The number of children was greatest for printing and publishing, newspapers and periodicals, with earnings averaging $2.78. The industries showing the highest averages were—for men, marble and stone work, $14.49; for women, foundry and machine shop products, $7.48; and for children, flour and grist mill products, $6. Those

showing the lowest were—for men and women, pickles, preserves, and sauces, $3.82 and $2.39; and for children, butter, and cheese, each, $1.

Leading industries in Missouri to the number of 10 include over two-fifths of the wage-earners considered for the state. In these industries the average earnings of men were $11.55. In 7 of the selected industries higher averages are shown, the highest, $13.77, being for clothing, men's, and the lowest, $8.24, for lumber and timber products. Several industries reported a large number of men, the first in this respect being cars, steam railroad, not including operations of railroad companies, with earnings averaging $10.47; the second was steam railroad repair shops, with an average of $12.46; the third was foundry and machine shop products, an allied industry, in which the average earnings were $12.48. One of the foremost industries was the manufacture of boots and shoes, and in this the average earnings, $12.04, were higher than for the state or for the selected industries. The highest average earnings for women in the leading industries, $8, were reported for steam railroad repair shops. The least average, $3, was reported for lumber and timber products, but the number reported in each instance was small and had little effect upon the general average. The largest number of women was reported for men's clothing where the average earnings were $6.05. A large proportion was reported from boot and shoe factories, in which the average earnings were $7.65, an amount much higher than the average of $6.02 for the state or of $6.19 for the selected industries. There were also considerable numbers reported for printing and publishing, book and job, and printing and publishing, newspapers and periodicals; in the former the average was $6.18, and in the latter, $4.52. Of children, the greatest number in the selected industries was employed in the manufacture of boots and shoes. Their average earnings were $3.69, compared with $3.55 for children in all industries in the state, and $3.57 for all of the 10 selected industries. The next largest numbers of children were reported for the 2 printing and publishing industries, with averages of $3.58 for book and job, and $2.63 for newspapers and periodicals. The lowest average was $2.57 in clothing, men's. The highest average, $4.26, was reported for lumber and timber products.

Men earned an average of $12.74 in North Dakota; women, $6.77; and children, $3. The leading industry in employment of men was printing and publishing, newspapers and periodicals; average earnings were $12.99. The greatest numbers of women and children were also returned for this industry, with average earnings of $7.57 and $3.29. The industry showing the highest average for men was foundry and machine shop products, $13.67; for women, printing and publishing, book and job, $7.83; for children, printing and publishing, newspapers and periodicals, $3.29. Those showing the lowest averages were—for men, bread and other bakery products, $10.85; and for women and children, tobacco, cigars and cigarettes, with average earnings of $3 and $1.67.

The industry in South Dakota for which the greatest number of men was reported was flour and grist mill products. The average earnings were $11.77, considerably below those for the state, $12.26. The greatest number of women was returned for printing and publishing, newspapers and periodicals; their average earnings were $6.86, a little higher than the average of $6.82 for all women in the state. The number of children was greatest for printing and publishing, newspapers and periodicals, with earnings averaging $3.38; considerably less than the $3.77, reported for the state. The highest average for men was $15.54, in lumber and timber products; for women, $9.67, in butter; for children, $8, in patent medicines and compounds. The lowest average for men was found in gas, illuminating and heating, $7.36; for women, in mineral and soda waters, $2.50; and for children, in printing and publishing, newspapers and periodicals, $3.38.

For men in Nebraska average earnings of $11.66 were reported; for women, $5.60; and for children, $4.20. The industry employing more men than any other was slaughtering and meat packing, wholesale, and in this the average earnings were $11.15. The greatest number of children was also returned for this industry, with average earnings of $5.09. The greatest number of women was returned for printing and publishing, newspapers and periodicals, average earnings being $5.60. The industry second in rank according to the number of men employed was steam railroad repair shops. The industries showing the highest averages were—for men, marble and stone work, $16.58; for women, furniture, $10.25; and for children, dairymen's, poulterers', and apiarists' supplies, $6. Those showing the lowest averages were, for men, hardware, $7.77; for women, food preparations, $4; and for children, carpets, rag, $1.

In Kansas the average earnings of men were $11.22; of women, $5.01; of children, $3.70. The leading industry in employment of men was slaughtering and meat packing, wholesale; average earnings were $11.16. The industry ranking second was steam railroad repair shops. The greatest number of women was returned for printing and publishing, newspapers and periodicals; earnings averaged $4.89. The number of children was greatest in slaughtering and meat packing, wholesale, and they earned on the average $4.65. The industries showing the highest averages were—for men, glass, $15.63; for women, trunks and valises, $11; and for children, fancy articles, not elsewhere specified, $6. The industries showing the lowest average earnings were—for men, patent medicines and compounds, $7.90; for women, carriages and wagons, $3; and for children, confectionery; gas, illuminating and heating; ice, manufactured; and mattresses and

spring beds, in each of which their earnings averaged $2.

Eastern South Central division.—While in no industry can this division show a value of production that equals one-half of the production in the United States, it presents several in which it is quite prominent. These include oil, cottonseed and cake; turpentine and rosin; tobacco, chewing and smoking, and snuff; lumber and timber products; iron and steel, blast furnaces; liquors, distilled; and iron and steel, steel works and rolling mills.

TABLE 47.—*Eastern South Central division—number and per cent of establishments and wage-earners included in weekly earnings, by states: 1905.*

ESTABLISHMENTS AND WAGE-EARNERS.	Eastern South Central division.	Kentucky.	Tennessee.	Alabama.	Mississippi.
Establishments, total number	10,311	3,734	3,175	1,882	1,520
Reporting no wage-earners	598	295	167	79	57
Reporting wage-earners	9,713	3,439	3,008	1,803	1,463
Included in weekly earnings	5,400	2,251	1,742	786	621
Per cent	55.6	65.5	57.9	43.6	42.4
Wage-earners, greatest number	301,829	82,421	83,505	83,332	52,571
Included in weekly earnings	107,392	35,590	33,092	26,191	12,519
Per cent	35.6	43.2	39.6	31.4	23.8

That the wage-earners shown in these statistics are representative of the industries included, is attested by the fact that over one-third of the greatest number employed at any one time by all establishments in the division are included.

The proportion of establishments shown is very much larger; that is, considerably over one-half. The state for which the highest proportion of both establishments and wage-earners is shown is Kentucky. Mississippi has the lowest proportion of both establishments and wage-earners. Kentucky contributes the largest number of the total for the division, although both Tennessee and Alabama reported a greater number of wage-earners employed at any one time, at the census of 1905.

The greatest average earnings were reported for Kentucky; the least, for Tennessee. The other states were nearer the average for Tennessee than the average for Kentucky. Kentucky's excess was 52 cents over the division's average. Of the state's wage-earning force, only 82.4 per cent were men, yet they received 90.5 per cent of the compensation. The proportion of women was much larger than that of any other state in the division, and they also participated more largely in the total earnings. In proportion of children Kentucky had least.

TABLE 48.—EASTERN SOUTH CENTRAL DIVISION—NUMBER AND PER CENT OF WAGE-EARNERS AT EACH AMOUNT OF CLASSIFIED EARNINGS, BY STATES: 1905.

WEEKLY EARNINGS.	EASTERN SOUTH CENTRAL DIVISION.		KENTUCKY.		TENNESSEE.		ALABAMA.		MISSISSIPPI.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Total	107,392	100.0	35,590	100.0	33,092	100.0	26,191	100.0	12,519	100.0
Less than $3	8,662	8.1	2,514	7.1	2,945	8.9	2,391	9.1	812	6.5
$3 to $4	8,080	7.5	2,617	7.3	2,782	8.4	2,089	8.0	592	4.7
$4 to $5	8,887	8.3	2,656	7.5	2,922	8.8	2,723	10.4	586	4.7
$5 to $6	8,161	7.6	2,548	7.2	2,328	7.0	2,599	9.9	686	5.5
$6 to $7	18,696	17.4	4,791	13.5	6,848	20.7	4,524	17.3	2,533	20.2
$7 to $8	14,921	13.9	4,389	12.3	4,487	13.6	3,404	13.0	2,641	21.1
$8 to $9	6,209	5.8	2,443	6.9	1,642	5.0	1,560	6.0	564	4.5
$9 to $10	9,087	8.5	3,257	9.1	2,475	7.5	1,476	5.6	1,879	15.0
$10 to $12	7,750	7.2	3,323	9.3	1,983	6.0	1,675	6.4	760	6.1
$12 to $15	7,637	7.1	3,353	9.4	2,033	6.1	1,550	5.9	701	5.6
$15 to $20	6,681	6.2	2,444	6.9	2,057	6.2	1,604	6.1	576	4.6
$20 to $25	1,612	1.5	659	1.8	407	1.2	422	1.6	124	1.0
$25 and over	1,009	0.9	596	1.7	183	0.6	174	0.7	56	0.5
Earnings for the specified week:										
Total	$844,296		$298,109		$248,431		$200,255		$97,501	
Average per wage-earner	$7.86		$8.38		$7.51		$7.65		$7.79	

The most important industry in the division in these statistics, measured by the number of wage-earners included, was lumber and timber products, followed by steam railroad repair shops, cotton goods, and foundry and machine shop products. A considerable number of wage-earners is also shown for oil, cottonseed and cake, and for iron and steel, blast furnaces.

TABLE 49.—*Eastern South Central division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905.*

[Size of establishments determined by the average number of wage-earners employed during the year.]

STATE.	Number of wage-earners.	PER CENT IN EACH CLASS OF ESTABLISHMENTS.					
		Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
	ALL WAGE-EARNERS.						
Eastern South Central division	107,392	19.3	22.9	21.3	15.1	7.0	14.4
Kentucky	35,590	23.7	27.6	19.2	14.8	3.6	11.1
Tennessee	33,092	20.3	20.3	28.4	15.7	8.3	7.0
Alabama	26,191	11.8	13.5	17.5	17.6	10.5	29.1
Mississippi	12,519	19.3	36.5	16.6	9.3	5.6	12.7
	MEN 16 YEARS AND OVER.						
Eastern South Central division	91,263	21.2	24.3	21.3	13.3	6.3	13.6
Kentucky	29,333	26.9	28.7	17.3	11.9	4.4	10.8
Tennessee	28,004	22.4	21.3	29.2	14.8	6.2	6.1
Alabama	22,459	13.0	14.8	19.0	16.5	10.3	26.4
Mississippi	11,467	20.0	39.0	16.7	6.8	3.8	13.7
	WOMEN 16 YEARS AND OVER.						
Eastern South Central division	10,961	6.9	17.5	22.0	26.8	9.4	17.4
Kentucky	5,015	6.8	23.1	28.0	29.0	....	13.1
Tennessee	3,425	8.0	17.9	22.3	23.4	18.9	9.5
Alabama	1,973	4.2	5.0	8.1	24.9	10.7	47.1
Mississippi	548	11.0	9.1	14.2	34.5	31.2	....
	CHILDREN UNDER 16 YEARS.						
Eastern South Central division	5,168	10.5	10.6	19.8	23.1	13.1	22.9
Kentucky	1,242	17.0	19.3	26.7	25.9	....	11.1
Tennessee	1,663	11.2	9.6	26.7	15.1	21.3	16.1
Alabama	1,759	4.3	5.5	9.4	24.3	13.1	43.4
Mississippi	504	13.9	9.9	16.3	38.3	18.4	3.2

Only 21.4 per cent of the total number of wage-earners was reported by factories employing an annual average of 300 or more.

Dividing the six groups of factories into those employing under 150 and those employing more than that number, only 36.5 per cent of all wage-earners in the division are found to have been employed in establishments of the larger size. Alabama was the state having the largest proportion, or 57.2 per cent. Mississippi had the smallest proportion, or 27.6 per cent. Of the men in this division, only about one-third were employed in the larger factories, Alabama, as was the case with all wage-earners, having the highest proportion, or a little more than one-half, and Mississippi having the least, about one-fourth. Kentucky and Tennessee were equal in their proportions—27.1 per cent each. It is to be noticed that Alabama had over one-fourth of its men wage-earners in factories of the very largest size, those employing an annual average of 500 or more. This proportion, however, was slightly less than that for the same state for all wage-earners.

A little above one-half of the women were in factories of the larger size; Alabama led with 82.7 per cent, having nearly one-half in the very largest establishments. Kentucky had the greatest proportion in the smaller establishments.

Of the children reported for the division, nearly 60 per cent were in the larger factories. The proportion for Alabama was the greatest, substantially the same as that reported for women, 80.8 per cent. Kentucky's proportion was the lowest, being a little over one-third.

The 10 industries selected to represent Kentucky in Table 72 include over one-half of the wage-earners shown for the state in statistics of weekly earnings, and a little more than two-fifths of the greatest number employed in all establishments at any one time. The average earnings of men in the state were $9.20, compared with $8.96 for the selected industries, showing that the leading industries were not those in which the highest earnings prevailed for a large number of wage-earners; yet of these 10, the average earnings reported in 7 were higher than for the group, and in 6, higher than for the state. In steel works and rolling mills earnings averaged the highest, $14.16, and the lowest, $6.82, in tobacco, chewing and smoking, and snuff. The greatest number of men was reported for lumber and timber products, in which the average earnings were $6.91. For women, in all the industries included for the state, the earnings averaged $4.94, which was a little lower than in the selected industries. The highest average, $7.67, was earned in steam railroad repair shops, but it had little influence on the general average because of the small number employed; the least, $3, was in flour and grist mill products. Over 30 per cent of the women reported for this state were returned for clothing, men's, and over 11 per cent for tobacco, chewing and smoking, and snuff, the average earnings being $5.14 and $5.19. Children, on the average, earned $2.81 in the state and $2.56 in the selected industries. Earnings averaged highest, $3.75, in planing mills, and lowest, $2.14, in flour and grist mills. Nearly one-half of the number shown for selected industries were returned from factories manufacturing chewing and smoking tobacco and snuff, where average earnings were $2.17.

The wage-earners shown in the 10 industries selected to represent the leading manufactures of Tennessee constitute 35 per cent of the greatest number employed at any one time during the year in the state in these industries. Earnings of men in the state averaged $8.17, which was 7 cents more than for the selected industries. The highest average was $10.79, returned for steam railroad repair shops; the lowest, $5.55, for hosiery and knit goods. A greater number of men than in any other industry was employed in the manufacture of lumber and timber products, with average earnings of $6.94, and the next greatest in steam railroad repair shops. Of the women in the

state, 45.2 per cent were reported engaged in the manufacture of hosiery and knit goods, cotton goods, and woolen goods. Their earnings averaged $4.10, $4.89, and $4.06, respectively. The general average for women for the state was $4.37 and for the selected industries, $4.31. The highest average is shown for cotton goods, and the lowest, $2.72, for lumber and timber products. Earnings of children averaged $2.73 for the state and $2.69 for the selected industries, a result considerably due to the comparatively large numbers and earnings reported for cotton and woolen goods, the average earnings for which were $3.03 and $2.50. The highest average earnings were $3.80, in blast furnaces, and the lowest, $2.31, in clothing, men's.

The 7 selected industries shown for Alabama include a number for which the state is well known, namely, lumber and timber products, cotton goods, and iron and steel, blast furnaces. The most important in the number of men employed was steam railroad repair shops. Earnings on the average were higher, $10.93, than in any other of the selected industries, and considerably higher than for the state, $8.30. Men received the lowest average, $5.77, in the manufacture of cotton goods. The manufacture of lumber and timber products engaged the attention of the second greatest number of men reported. In one of Alabama's characteristic industries, blast furnaces, the earnings of men averaged $9.27. Women are shown for only 2 of the selected industries, but in 1 of these, cotton goods, the number shown includes 88.2 per cent of the total number of women wage-earners reported for the state. The average earnings of women for the state were $4.46, and for cotton goods, $4.43. The smallest average, $3.29, is shown for steam railroad repair shops. Of the children reported, 89.3 per cent were employed in the manufacture of cotton goods, in which employment they averaged earnings of $2.83. The state average was $2.85. The highest average earnings, $6.75, were reported for steam railroad repair shops, and the lowest, $2.33, for foundry and machine shop products.

Lumber and timber products was the industry for which, in Mississippi, the only state in the division not shown by selected industries, the greatest number of men was returned. The average earnings were $8.32, which was higher than the state average of $8.15. Many men were also reported for oil, cottonseed and cake, another industry peculiar to Southern states. Their earnings averaged $6.46. Earnings averaged highest, $12.47, in the production of monuments and tombstones, and lowest, $4.22, in flour and grist mills. Women were most numerously employed in the manufacture of cotton goods, in which their earnings averaged $4.84, compared with $4.79 for the state. Earnings were greatest, on the average, $8.17, in printing and publishing, book and job, and least, $1.70, in oil, cottonseed and cake. A greater number of children were returned for cotton goods than for any other industry, and their average earnings were $2.52, which was less than the state average of $2.78. It was in lumber and timber products that the earnings of children averaged most, $3.98, and in carriages and wagons the least, $2.

Western South Central division.—In a number of important industries this division at the census of 1905 reported a considerable proportion of the total value of products for the United States. The value of the production of oil, cottonseed and cake, reached 41.4 per cent, and that of sugar and molasses, refining, 27.3 per cent of the total for the country. In lumber and timber products the division had a smaller percentage of the total but a greater absolute value than in either industry mentioned.

TABLE 50.—*Western South Central division—number and per cent of establishments and wage-earners included in weekly earnings, by states and territories: 1905.*

ESTABLISHMENTS AND WAGE-EARNERS.	Western South Central division.	Louisiana.	Arkansas.	Indian Territory.	Oklahoma.	Texas.
Establishments, total number	8,279	2,091	1,907	466	657	3,158
Reporting no wage-earners	625	111	79	52	85	298
Reporting wage-earners	7,654	1,980	1,828	414	572	2,860
Included in weekly earnings	4,351	748	1,015	332	454	1,802
Per cent	56.8	37.8	55.5	80.2	79.4	63.0
Wage-earners, greatest number	216,104	88,250	50,530	3,840	4,619	68,865
Included in weekly earnings	66,906	17,043	17,780	2,153	2,253	27,677
Per cent	31.0	19.3	35.2	56.1	48.8	40.2

The proportions in which establishments and wage-earners of industries are included in these statistics are such as to make returns for at least 4 of the states representative.

For the division as a whole considerably more than one-half of the establishments employing wage-earners and nearly one-third of the wage-earners are included. Louisiana, which in 1905 reported the largest aggregate number of wage-earners employed at any one time in the division, appears in these returns with a smaller proportion of its own total than the proportion given for any other state. Indian Territory, which returned the least number of wage-earners, supplies the greatest proportion of its total. Of the wage-earners in the division, Texas had the greatest number, 41.4 per cent.

Every state or territory but Arkansas had larger average earnings than the division. Indian Territory led in the averages, Oklahoma was second, Texas third, and Louisiana fourth.

These comparisons show that the two territories, although contiguous to the older states of the division, present, in a measure, the economic conditions of newly settled communities.

TABLE 51.—WESTERN SOUTH CENTRAL DIVISION—NUMBER AND PER CENT OF WAGE-EARNERS AT EACH AMOUNT OF CLASSIFIED EARNINGS, BY STATES AND TERRITORIES: 1905.

WEEKLY EARNINGS.	WESTERN SOUTH CENTRAL DIVISION.		LOUISIANA.		ARKANSAS.		INDIAN TERRITORY.		OKLAHOMA.		TEXAS.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Total	66,906	100.0	17,043	100.0	17,780	100.0	2,153	100.0	2,253	100.0	27,677	100.0
Less than $3	5,774	8.6	1,181	6.9	2,114	11.9	23	1.1	46	2.1	2,410	8.7
$3 to $4	3,301	4.9	962	5.6	959	5.4	37	1.7	58	2.6	1,285	4.7
$4 to $5	3,259	4.9	928	5.4	1,024	5.8	26	1.2	66	2.9	1,215	4.4
$5 to $6	3,198	4.8	892	5.2	1,064	6.0	56	2.6	88	3.9	1,098	4.0
$6 to $7	5,472	8.2	1,281	7.5	1,962	11.0	79	3.7	119	5.3	2,031	7.3
$7 to $8	7,672	11.5	1,868	11.0	2,408	13.5	252	11.7	127	5.6	3,017	10.9
$8 to $9	5,280	7.9	1,528	9.0	1,635	9.2	105	4.9	85	3.8	1,927	7.0
$9 to $10	9,751	14.6	2,305	13.5	2,495	14.0	505	23.4	532	23.6	3,914	14.1
$10 to $12	7,790	11.6	2,185	12.8	1,698	9.6	320	14.9	343	15.2	3,244	11.7
$12 to $15	7,380	11.0	2,023	11.9	1,241	7.0	398	18.5	446	19.8	3,272	11.8
$15 to $20	5,595	8.4	1,410	8.3	803	4.5	251	11.6	296	13.1	2,835	10.3
$20 to $25	1,627	2.4	298	1.8	250	1.4	88	4.1	40	1.8	951	3.4
$25 and over	807	1.2	182	1.1	127	0.7	13	0.6	7	0.3	478	1.7
Earnings for the specified week:												
Total	$606,938		$156,038		$141,341		$23,286		$23,199		$263,074	
Average per wage-earner	$9.07		$9.16		$7.95		$10.82		$10.30		$9.51	

Arkansas, of total wage-earners in a state or territory of this division, had the greatest proportion of men and Louisiana the least. These positions were reversed for women and children. The high levels of earnings for all wage-earners in Indian Territory and Oklahoma were maintained by these territories also in the average earnings of men, women, and children.

The industry employing the largest number of wage-earners included in these statistics for the division was lumber and timber products; the industry employing the next largest number was steam railroad repair shops; oil, cottonseed and cake, was third.

Of all wage-earners, somewhat less than one-sixth were reported in factories of the very largest size, that is, those employing an average of 500 or more wage-earners annually, and less than 40 per cent were in establishments having an annual average of 150 or over, which may be denominated the larger as distinguished from the smaller of the six classes.

Of the men, even a less proportion than that of all wage-earners was employed in these larger factories, and while the proportions of women increased considerably, those for children diminished. No wage-earners were returned in Indian Territory for the largest two groups, and but a small proportion of men for factories employing annually an average of from 150 to 300. The largest establishments for which returns were made from Oklahoma for men, women, or children were such as employed from 10 to 50 wage-earners. The returns for Texas show no women or children in factories of the largest two groups. Louisiana is the only state with a proportion of all three classes—men, women, and children—in the larger factories, although Texas had over 40 per cent of its men in them.

Of the states in the division, only Louisiana is represented by selected manufactures. The 5 leading industries illustrative of the character of the manufactures of Louisiana embrace establishments having about one-fifth of the greatest number of wage-earners employed in all establishments in the state in those industries. The average earnings of men in the state were $9.93, and in the selected industries, $9.86. The highest average earnings in the selected industries appear for sugar and molasses, refining, $11.27, and the lowest, $7.14, for oil, cottonseed and cake. The industry employing the largest number of men was lumber and timber products, and in this the average earnings were $9.67. About one-half the women were returned for tobacco, cigars and cigarettes, in which average earnings were $4.52, exactly those for the state. The only other selected industry in which women were employed was sugar and molasses, refining, in which the average was $5.75. Nearly all the children shown in the selected industries were employed in the manufacture of cigars and cigarettes. Their earnings averaged $3.84, considerably more than the general average for the state, which was $3.23. The highest average earnings for children, $5.14, were returned for lumber and timber products, and the lowest, $3, for sugar and molasses, refining.

The men in Arkansas earned on the average $8.11. By far the largest number of men, or 63.6 per cent of all included for the state, were returned for lumber and timber products. Earnings averaged $7.66. The highest average was $13.80 in the manufacture of cigars and cigarettes; the lowest, $6, in canning and preserving, fruits and vegetables. The average earnings of women were $4.13, and of children, $2.88. A large percentage of the women were employed in printing and publishing, newspapers and periodicals, in which they averaged $4.70 in earnings. The greatest number of children were reported for the manufacture of lumber and timber products, with average earnings of $2.81. The average earnings of women were greatest, $12, in cigars and cigarettes, and least, $1.77, in furniture; for children the highest earnings were $5 in foundry and machine shop products, and the lowest, $2, in oil, cottonseed and cake.

TABLE 52.—*Western South Central division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states and territories: 1905.*

[Size of establishments determined by the average number of wage-earners employed during the year.]

STATE OR TERRITORY.	Number of wage-earners.	PER CENT IN EACH CLASS OF ESTABLISHMENTS. Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
	ALL WAGE-EARNERS.						
Western South Central division	66,906	23.3	22.5	14.3	16.2	7.5	16.2
Louisiana	17,043	15.2	10.1	19.1	21.8	17.1	16.7
Arkansas	17,780	22.4	29.3	18.6	17.0	4.8	7.9
Indian Territory	2,153	61.3	24.6	3.0	11.1		
Oklahoma	2,253	66.5	33.5				
Texas	27,677	22.3	24.8	10.5	14.0	4.6	23.8
	MEN 16 YEARS AND OVER.						
Western South Central division	61,887	22.8	23.1	14.4	16.2	7.0	16.5
Louisiana	14,723	15.8	11.1	20.4	22.6	15.0	15.1
Arkansas	17,133	21.2	29.3	18.7	17.6	5.0	8.2
Indian Territory	2,054	59.6	25.6	3.2	11.6		
Oklahoma	2,037	63.5	36.5				
Texas	25,940	21.7	24.6	10.2	13.2	4.9	25.4
	WOMEN 16 YEARS AND OVER.						
Western South Central division	3,728	25.2	13.5	13.6	19.1	15.3	13.3
Louisiana	1,824	6.7	4.3	12.3	18.2	31.4	27.1
Arkansas	359	65.5	20.6	13.9			
Indian Territory	64	96.9	3.1				
Oklahoma	172	94.8	5.2				
Texas	1,309	27.3	26.0	17.8	28.9		
	CHILDREN UNDER 16 YEARS.						
Western South Central division	1,291	39.9	22.1	8.8	8.8	11.0	9.4
Louisiana	496	26.4	3.2	6.3	10.9	28.6	24.6
Arkansas	288	42.7	41.0	13.2	3.1		
Indian Territory	35	94.3	5.7				
Oklahoma	44	95.5	4.5				
Texas	428	43.4	34.6	10.3	11.7		

In Indian Territory the average earnings of men were $11.11. The industry employing the greatest number was steam railroad repair shops, and the compensation paid averaged $13.42. The highest average, $14.92, was paid in planing mills, and the lowest, $8.59, in the mineral and soda water manufacture. Earnings of women averaged $5.33 in general, and $5.30 in printing and publishing, newspapers and periodicals, the industry for which almost all of them were returned. The only other industry in which they appear separately is that of cigars and cigarettes; in this their earnings averaged $4. Nearly one-half of the children, for whom returns are included, were employed in printing and publishing, newspapers and periodicals, their earnings averaging $3.27, compared with the general average of $3.49. They earned most on the average, $7, in foundry and machine shops and book and job printing and publishing establishments, and least, $2, in the manufacture of cigars and cigarettes.

The industry in Oklahoma employing the largest number of men was flour and grist mill products, in which their average earnings were $10.99, being a little higher than the general average for men, $10.82. Planing mills returned the highest average earnings, $14.71, and patent medicines and compounds the least, $8.22. Women earned an average of $5.81, by far the greatest proportion being returned for printing and publishing, newspapers and periodicals, in which employment their average earnings were $5.90. The largest average earnings were $8 for butter, and the least, $4.25, for mineral and soda waters. More than one-half of the children were employed in the newspaper industry. Their average earnings in this were $3.42, but the general average was a little higher, or $3.64. Earnings averaged highest, $7.50, in the mineral and soda water manufacture, and least, $2.50, in cigar factories.

In Texas the earnings of men averaged $9.84 for all industries reported. The average for lumber and timber products, in which the largest numbers were employed, was $8.02. For steam railroad repair shops the next largest number was returned, with average earnings of $12.25. Oil, cottonseed and cake, employed also a large number, and earnings averaged $8.01. For jewelry the highest average, $16.80, and for wood preserving, the lowest, $6.44, was reported. The average earnings of women were $5.03 for the state, and $5.74 for the industry, clothing, men's, in which women were reported in greatest number. In the manufacture of soap, earnings were the highest, $10, and in canning and preserving, fruits and vegetables, they were the lowest, $2.97. Children were employed in printing and publishing, newspapers and periodicals, more largely than in any other industry, and earned on the average in that industry $2.76, which was considerably less than the state average of $3.08. In the manufacture of furniture they received the most on the average, $4.57, and the least, $2, in marble and stone work, and in the production of stencils and brands.

Rocky Mountain division.—The 4 states and 1 territory constituting this division contributed to the United States total a considerable part of the value of products of a number of important manufactures at the census of 1905. The most important of these industries were the smelting and refining of copper, and of lead, and the manufacture of beet sugar.

The proportion that the wage-earners included in these statistics forms of all wage-earners in the division is larger than that shown for some of the other and more important manufacturing sections.

TABLE 53.—*Rocky Mountain division—number and per cent of establishments and wage-earners included in weekly earnings, by states and territories: 1905.*

ESTABLISHMENTS AND WAGE-EARNERS.	Rocky Mountain division.	Montana.	Idaho.	Wyoming.	Colorado.	New Mexico.
Establishments, total number	2,720	382	364	169	1,606	199
Reporting no wage-earners	386	49	33	23	246	35
Reporting wage-earners	2,334	333	331	146	1,360	164
Included in weekly earnings	1,616	227	183	101	999	106
Per cent	69.2	68.2	55.3	69.2	73.5	64.6
Wage-earners, greatest number	54,396	11,495	5,466	2,511	30,222	4,702
Included in weekly earnings	23,429	4,698	1,548	2,175	12,856	2,152
Per cent	43.1	40.9	28.3	86.6	42.5	45.8

Wyoming is represented by nearly seven-eighths of its greatest number of wage-earners, but Idaho has considerably less than one-third. Colorado reported the largest part of the total for the division, 54.9 per cent, and Idaho the smallest, 6.6 per cent.

In average earnings this division led all divisions. The Basin and Plateau division was next in rank, but its average earnings were lower by 25 cents for all wage-earners—2 cents for men, $1.68 for women, and $1.69 for children.

Montana led in earnings of men, the average for the state being $18.60; Wyoming was second, with $15.93. The average earnings for women in Idaho and for children in Colorado were next to those reported for Montana, which were the highest. Except for children, all average earnings were lowest in New Mexico; the children receiving the least in Wyoming.

TABLE 54.—ROCKY MOUNTAIN DIVISION—NUMBER AND PER CENT OF WAGE-EARNERS AT EACH AMOUNT OF CLASSIFIED EARNINGS, BY STATES AND TERRITORIES: 1905.

WEEKLY EARNINGS.	ROCKY MOUNTAIN DIVISION.		MONTANA.		IDAHO.		WYOMING.		COLORADO.		NEW MEXICO.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Total	23,429	100.0	4,698	100.0	1,548	100.0	2,175	100.0	12,856	100.0	2,152	100.0
Less than $3	302	1.3	34	0.7	8	0.5	33	1.5	132	1.0	95	4.4
$3 to $4	285	1.2	47	1.0	2	0.1	31	1.4	154	1.2	51	2.4
$4 to $5	331	1.4	30	0.6	15	1.0	43	2.0	208	1.6	35	1.6
$5 to $6	424	1.8	42	0.9	19	1.2	30	1.4	268	2.1	65	3.0
$6 to $7	667	2.8	72	1.5	34	2.2	41	1.9	401	3.1	119	5.5
$7 to $8	509	2.2	47	1.0	17	1.1	26	1.2	317	2.5	102	4.7
$8 to $9	726	3.1	50	1.1	15	1.0	45	2.1	460	3.6	156	7.3
$9 to $10	1,325	5.7	62	1.3	58	3.7	97	4.4	809	6.3	299	13.9
$10 to $12	1,980	8.5	110	2.4	53	3.4	231	10.6	1,216	9.5	370	17.2
$12 to $15	5,584	23.8	971	20.7	650	42.0	431	19.8	3,207	24.9	325	15.1
$15 to $20	6,583	28.1	1,212	25.8	498	32.2	613	28.2	4,052	31.5	208	9.7
$20 to $25	3,399	14.5	1,424	30.3	117	7.6	506	23.3	1,149	8.9	203	9.4
$25 and over	1,314	5.6	597	12.7	62	4.0	48	2.2	483	3.8	124	5.8
Earnings for the specified week:												
Total	$350,590		$85,462		$22,931		$34,254		$181,739		$26,204	
Average per wage-earner	$14.96		$18.19		$14.81		$15.75		$14.14		$12.18	

In no other division did the men constitute such a large, and the women such a small proportion of the divisional total.

For lumber and timber products the largest number of wage-earners was reported, followed by steam railroad repair shops and beet sugar.

About one-third of all wage-earners were in factories having an average of at least 150 wage-earners annually. The proportion was but slightly greater for men, while for children it was more than one-fourth.

The conditions in Montana and New Mexico contributed most largely to offset the overwhelming preponderance of wage-earners in the smaller establishments in Idaho and Colorado. In Idaho all the men, and in Colorado all but 23 per cent of them, were in factories employing an annual average of less than 150 wage-earners. In Wyoming and New Mexico all the women, and in Wyoming all the children, were in establishments employing an annual average of less than 10 wage-earners, but the actual numbers were small.

No state or territory in the division is represented in these statistics by selected industries. The men returned for Montana earned an average of $18.60; the women, $8.60; and the children, $7.09. The industry employing the greatest number of men was lumber and timber products. The average earnings were $14.58. The greatest numbers of women and children were returned for bread and other bakery products; their earnings averaged $6.72 and $4.77, respectively. The highest average earnings for men were $25.96, in monuments and tombstones; for women, $11.77, in printing and publishing, newspapers and periodicals; and for children, $8, in foundry and machine shop products. The lowest averages for men were reported in the manufacture of lumber and timber products, $14.58; for women, in tobacco, cigars and cigarettes, $3; and for children, in carriages and wagons, $3.

The average earnings of men in Idaho were $15.30. The industry leading in their employment was lumber and timber products, and the average earnings were $14.16. Women in the state earned an average of $7.62. The greatest number was returned for printing and publishing, newspapers and periodicals, and their average earnings were $8.19. Children were also most

numerous in this industry, averaging $3.54, an amount considerably lower than their average of $4.93 for the state. The industries showing the highest averages were—for men, tobacco, cigars and cigarettes, $19.26; for women, liquors, malt, $9; and for children, brick and tile, lumber, planing mill products, including sash, doors, and blinds, and mineral and soda waters, $6. Industries showing lowest averages were—for men, mineral and soda waters, $12; for women, lumber and timber products, $4.25; and for children, printing and publishing, newspapers and periodicals, $3.54.

TABLE 55.—*Rocky Mountain division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states and territories: 1905.*

[Size of establishments determined by the average number of wage-earners employed during the year.]

STATE OR TERRITORY.	Number of wage-earners.	PER CENT IN EACH CLASS OF ESTABLISHMENTS. Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
	ALL WAGE-EARNERS.						
Rocky Mountain division	23,429	22.4	17.4	25.9	15.5	6.9	11.9
Montana	4,698	14.3	8.5	16.4	5.1	15.0	40.7
Idaho	1,548	41.4	37.1	21.5	....	....	....
Wyoming	2,175	15.2	8.1	34.9	16.2	25.6	....
Colorado	12,856	25.6	22.1	30.9	21.4	....	....
New Mexico	2,152	14.5	3.5	10.1	14.0	16.9	41.0
	MEN 16 YEARS AND OVER.						
Rocky Mountain division	22,007	21.0	17.1	25.7	16.4	7.4	12.4
Montana	4,514	13.2	8.4	15.7	5.3	15.6	41.8
Idaho	1,460	38.2	39.1	22.7	....	....	....
Wyoming	2,132	13.5	8.3	35.6	16.5	26.1	....
Colorado	11,811	24.6	21.6	30.8	23.0	....	....
New Mexico	2,090	14.0	3.6	10.3	14.3	17.4	40.4
	WOMEN 16 YEARS AND OVER.						
Rocky Mountain division	1,103	40.7	23.9	33.9	1.5	....	....
Montana	126	42.9	14.2	42.9	....	....	....
Idaho	61	98.4	1.6	....	....	....	....
Wyoming	33	100.0	....	....	....	....	....
Colorado	[illegible]	33.2	28.2	36.8	1.8	....	....
New Mexico	9	100.0	....	....	....	....	....
	CHILDREN UNDER 16 YEARS.						
Rocky Mountain division	319	48.9	14.7	11.0	6.0	....	19.4
Montana	58	36.2	3.5	17.2	1.7	....	41.4
Idaho	27	85.2	14.8	....	....	....	....
Wyoming	5	100.0	....	....	....	....	....
Colorado	176	55.1	22.7	14.2	8.0	....	....
New Mexico	53	18.9	1.9	....	7.5	....	71.7

The industry in Wyoming employing more men than any other was steam railroad repair shops. The average earnings were $14.54, a little lower than the state average, $15.93. The greatest numbers of women and children were returned for printing and publishing, newspapers and periodicals; their average earnings were $7.12 and $4, compared with the general average of $7.18 and $3.40 for the state. The industries showing the highest averages were—for men, lumber and timber products, $21.48; for women, bread and other bakery products, $10; and for children, printing and publishing, newspapers and periodicals, $4. The industry showing the lowest averages for men and women was butter, $12.30 and $5.50, respectively, and for children, tobacco, cigars and cigarettes, $2.50.

Of average earnings reported for Colorado, those of men were $14.78; of women, $7.14; of children, $5.84. The industry first in number of men employed was beet sugar. The average earnings were $16.22. The greatest number of women was returned for bread and other bakery products, and their earnings averaged $6.59. The number of children was greatest for printing and publishing, book and job; their average earnings were $5.03. The industries showing the highest averages were—for men, coppersmithing and sheet iron working, $20.07; for women, beet sugar, $14; and for children, lumber and timber products, $12. The industries showing the lowest averages were—for men, carpets, rag, $7.43; for women, flavoring extracts, $5; and for children, food preparations, $2.67. The industry second in rank, according to number of men, was foundry and machine shop products. The industry ranking second, according to number of women, was confectionery, and according to number of children, beet sugar.

The earnings of men in New Mexico averaged $12.42; and the industry that employed them in greatest number was lumber and timber products, for which 41.4 per cent of the number returned for the territory was reported. Their average earnings were $9.59. The industry second in rank was steam railroad repair shops, for which 39.8 per cent of all the men was returned. Women were reported for only 2 of the selected industries, namely, bread and other bakery products and printing and publishing, newspapers and periodicals; their average earnings were $4.33 and $8.33, respectively, compared with the territorial average of $6.22 for women in all industries. The number of children returned was greatest for lumber and timber products; their earnings averaged $2.92, an amount lower than the general average of $3.49. The industries showing the highest averages were—for men, lumber, planing mill products, including sash, doors, and blinds, $16.71; for women, printing and publishing, newspapers and periodicals, $8.33; and for children, bread and other bakery products, $9. Industries showing the lowest average earnings were—for men and children, lumber and timber products, with averages of $9.60 and $2.92, respectively, and for women, bread and other bakery products, with an average of $4.33.

Basin and Plateau division.—By far the most important industry of this division according to value of products, as returned at the census of 1905, was the smelting and refining of copper; 13 per cent in value of the product of the entire country was manufactured here. Considerable lead also was smelted.

TABLE 56.—*Basin and Plateau division—number and per cent of establishments and wage-earners included in weekly earnings, by states and territories: 1905.*

ESTABLISHMENTS AND WAGE-EARNERS.	Basin and Plateau division.	Arizona.	Utah.	Nevada.
Establishments, total number	890	169	606	115
Reporting no wage-earners	61	14	37	10
Reporting wage-earners	829	155	569	105
Included in weekly earnings	515	114	313	88
Per cent	62.1	73.5	55.0	83.8
Wage-earners, greatest number	19,035	6,028	11,876	1,131
Included in weekly earnings	6,518	3,398	2,466	654
Per cent	34.2	56.4	20.8	57.8

While only one-third of the greatest number of wage-earners employed at any one time, in all establishments in the division, has been included in these statistics, the proportions for Arizona and Nevada are much over one-half. Utah has only about one-fifth.

TABLE 57.—*Basin and Plateau division—number and per cent of wage-earners at each amount of classified earnings, by states and territories: 1905.*

WEEKLY EARNINGS.	BASIN AND PLATEAU DIVISION.		ARIZONA.		UTAH.		NEVADA.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Total wage-earners for the week	6,518	100.0	3,398	100.0	2,466	100.0	654	100.0
Less than $3	115	1.8	81	2.4	32	1.3	2	0.3
$3 to $4	122	1.9	31	0.9	88	3.6	[illegible]	0.5
$4 to $5	118	1.8	28	0.8	87	3.5	3	0.5
$5 to $6	235	3.6	37	1.1	193	7.8	5	0.8
$6 to $7	212	3.2	41	1.2	161	6.5	10	1.5
$7 to $8	106	1.6	44	1.3	54	2.2	[illegible]	1.2
$8 to $9	124	1.9	51	1.5	67	2.7	6	0.9
$9 to $10	445	6.8	149	4.4	286	11.6	10	1.5
$10 to $12	714	11.0	342	10.1	359	14.6	13	2.0
$12 to $15	1,214	18.6	633	18.6	447	18.1	134	20.5
$15 to $20	1,699	26.1	962	28.3	470	19.1	267	40.8
$20 to $25	940	14.4	670	19.7	147	6.0	123	18.8
$25 and over	474	7.3	329	9.7	75	3.0	70	10.7
Earnings for the specified week:								
Total	$95,912		$54,875		$29,423		$11,614	
Average per wage-earner	$14.71		$16.15		$11.93		$17.76	

Of the aggregate number of wage-earners included in the statistics for the division, the greatest number, or 52.1 per cent, is shown for Arizona, and the least, or 10 per cent, for Nevada.

In average earnings of all wage-earners and of men the division stood second in all the country, although the numbers were comparatively small.

Nevada returned the highest average earnings for all wage-earners and Utah the lowest.

This division ranks second in the proportion of men among its wage-earners. Arizona was first in this respect, with Nevada nearly equal. Utah presented conditions much like those of the Eastern and Southern states in proportions of women and children, which were higher than for any of the Western states excepting California.

The industry employing the largest number of wage-earners was smelting and refining of copper, followed by steam railroad repair shops and lumber and timber products.

TABLE 58.—*Basin and Plateau division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states and territories: 1905.*

[Size of establishments determined by the average number of wage-earners employed during the year.]

STATE OR TERRITORY.	Number of wage-earners.	PER CENT IN EACH CLASS OF ESTABLISHMENTS.					
		Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
	ALL WAGE-EARNERS.						
Basin and Plateau division	6,518	26.5	12.8	15.6	17.6	18.1	9.4
Arizona	3,398	11.3	4.4	17.8	26.1	22.3	18.1
Utah	2,466	42.8	17.4	12.1	10.5	17.2	
Nevada	654	44.0	39.2	16.8			
	MEN 16 YEARS AND OVER.						
Basin and Plateau division	6,044	25.0	12.6	15.9	16.7	19.6	10.2
Arizona	3,355	10.7	4.0	18.1	26.3	22.6	18.3
Utah	2,053	42.7	18.5	12.0	6.1	20.7	
Nevada	636	43.6	39.1	17.3			
	WOMEN 16 YEARS AND OVER.						
Basin and Plateau division	343	38.2	16.0	14.0	31.8		
Arizona	30	46.7	53.3				
Utah	299	36.8	10.7	16.0	36.5		
Nevada	14	50.0	50.0				
	CHILDREN UNDER 16 YEARS.						
Basin and Plateau division	131	64.1	13.8	1.5	20.6		
Arizona	13	84.6			15.4		
Utah	114	60.5	15.8	1.8	21.9		
Nevada	4	100.0					

Nearly 55 per cent of all the wage-earners were returned for factories employing an annual average of less than 150 wage-earners. All of those returned for Nevada and more than 70 per cent of those for Utah were in this class. Arizona had 66.5 per cent of wage-earners in the larger establishments. This distribution was substantially that of men also, but all the women reported for Arizona and Nevada were in establishments having less than 50, and all the children in Nevada, in establishments having less than 10 wage-earners.

No selected industries are shown in Table 72 for any state or territory in this division. In industries reported for Arizona average earnings of men were $16.27; of women, $7.50; of children, $4.77. The industry first in employment of men was smelting and refining, copper; the average earnings were $17.05. The industry ranking second in men was steam railroad repair shops. The greatest number of women was returned for printing and publishing, newspapers and periodicals, with average earnings of $7.58. Children were employed most numerously in printing and publishing, newspapers and periodicals, and in to-

bacco, cigars and cigarettes, their earnings averaging $4 and $4.50. The industries showing the highest averages were—for men, printing and publishing, newspapers and periodicals, $17.48; for women, bread and other bakery products, $11.60; and for children, lumber and timber products, $9. Those showing the lowest averages were—for men, mineral and soda waters, $12.93; for women, tobacco, cigars and cigarettes, $5; and for children, printing and publishing, newspapers and periodicals, $4.

The average earnings of men in Utah were $13.35, and in the industry for which they were reported in greatest number, steam railroad repair shops, their average was $15.17. The greatest number of women was returned for bread and other bakery products, with average earnings of $4.86; whereas, for the state as a whole, women's earnings averaged $5.34. The number of children returned was greatest for brick and tile, and while the average earnings reported for the state were $3.75, the average was $5.50 in this industry. The industries showing the highest averages were—for men, marble and stone work, $18.93; for women, printing and publishing, newspapers and periodicals, $7.33; and for children, lumber and timber products, $9. Industries showing the lowest averages were—for men, mineral and soda waters, $10.28; for women, butter, $2; and for children, pottery, terra cotta, and fire clay products, $1.

The leading industry in Nevada in the number of men reported was steam railroad repair shops, 11.8 per cent of the total number of men included for the state being employed in it. Their average earnings were $21.63, an average higher even than the high average of $18.05 for the state. The industry ranking second was printing and publishing, newspapers and periodicals, with 11.2 per cent of the total number of men. The greatest number of women was returned for bread and other bakery products; their average earnings were $8.44. In the state as a whole women's earnings averaged $8.29. The number of children was greatest for printing and publishing, newspapers and periodicals; their earnings averaged $4.67, and assisted in fixing the general average for the state at $4.50. The industries showing the highest averages were—for men, steam railroad repair shops, $21.63; for women, bread and other bakery products, $8.44; and for children, printing and publishing, newspapers and periodicals, $4.67. Those showing the lowest averages were—for men, mineral and soda waters, $15.81; for women, printing and publishing, newspapers and periodicals, $8; and for children, tobacco, cigars and cigarettes, $4.

Pacific division.—First in liquors, vinous, with 60.3 per cent of the total product of the country at the census of 1905, this division produced, also, 31.1 per cent in value of all the fruits and vegetables, canned and preserved; nearly 25 per cent of the canned and preserved fish; more than 18 per cent of the beet sugar; and 13.8 per cent of the lumber and timber products. One state in the division outranked all others in the United States in the production of lumber and timber products.

TABLE 59.—*Pacific division—number and per cent of establishments and wage-earners included in weekly earnings, by states: 1905.*

ESTABLISHMENTS AND WAGE-EARNERS.	Pacific division.	Washington.	Oregon.	California.
Establishments, total number	11,192	2,751	1,602	6,839
Reporting no wage-earners	1,111	234	169	708
Reporting wage-earners	10,081	2,517	1,433	6,131
Included in weekly earnings	6,501	1,331	822	4,348
Per cent	64.5	52.9	57.4	70.9
Wage-earners, greatest number	244,742	64,882	27,286	152,574
Included in weekly earnings	106,007	20,734	10,249	75,024
Per cent	43.3	32.0	37.6	49.2

The proportion that the wage-earners included in the statistics form of the greatest number reported at any one time in all establishments in the division is not quite one-half.

The greatest proportion of establishments employing wage-earners is shown for California and the smallest for Washington. Of the wage-earners in the division, the number for California is the greatest, 70.8 per cent, and for Oregon the least, 9.7 per cent.

TABLE 60.—*Pacific division—number and per cent of wage-earners at each amount of classified earnings, by states: 1905.*

WEEKLY EARNINGS.	PACIFIC DIVISION.		WASHINGTON.		OREGON.		CALIFORNIA.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Total wage-earners for the week.	106,007	100.0	20,734	100.0	10,249	100.0	75,024	100.0
Less than $3	2,498	2.4	346	1.7	218	2.1	1,934	2.6
$3 to $4	2,107	2.0	302	1.4	145	1.4	1,660	2.2
$4 to $5	2,649	2.5	327	1.6	173	1.7	2,149	2.9
$5 to $6	3,129	2.9	352	1.7	296	2.9	2,481	3.3
$6 to $7	4,363	4.1	489	2.4	459	4.5	3,415	4.6
$7 to $8	4,346	4.1	460	2.2	391	3.8	3,495	4.7
$8 to $9	3,505	3.3	794	3.8	337	3.3	2,374	3.2
$9 to $10	6,582	6.2	1,118	5.4	890	8.7	4,574	6.1
$10 to $12	12,241	11.5	2,469	11.9	1,567	15.3	8,205	10.9
$12 to $15	24,278	22.9	5,725	27.6	2,705	26.4	15,848	21.1
$15 to $20	24,699	23.3	5,348	25.8	1,915	18.7	17,436	23.2
$20 to $25	11,823	11.2	2,305	11.1	860	8.4	8,658	11.5
$25 and over	3,787	3.6	699	3.4	293	2.8	2,795	3.7
Earnings for the specified week:								
Total	$1,408,987		$287,020		$128,972		$992,995	
Average per wage-earner	$13.29		$13.84		$12.58		$13.24	

In average weekly earnings of all wage-earners, and of men, this division is higher than any of the other divisions except two; in average earnings of women and children there is but one greater.

Highest average earnings for all wage-earners were reported from Washington; for men and women, from California; for children, from Oregon.

Of the wage-earners in the division, nearly seven-eighths were men. The proportion was greatest in Washington and least in California.

The largest number of wage-earners in the division was returned for lumber and timber products and the next largest for canning and preserving, fruits and vegetables. The numbers reported for steam railroad repair shops and for foundry and machine shops

were also large. Other important industries that had a less effect, according to the number of wage-earners, were lumber, planing mill products, including sash, doors, and blinds, and the two printing and publishing industries, book and job and newspapers and periodicals.

TABLE 61.—*Pacific division—per cent of all wage-earners, and of men, women, and children, in establishments according to size, by states: 1905.*

[Size of establishments determined by the average number of wage-earners employed during the year.]

STATE.	Number of wage-earners.	PER CENT IN EACH CLASS OF ESTABLISHMENTS. Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
	ALL WAGE-EARNERS.						
Pacific division	106,007	21.8	22.6	22.6	13.3	5.0	14.7
Washington	20,734	23.9	25.2	22.1	15.0	2.1	11.7
Oregon	10,249	26.0	24.4	21.1	16.6	6.6	5.3
California	75,024	20.6	21.7	22.9	12.4	5.6	16.8
	MEN 16 YEARS AND OVER.						
Pacific division	90,990	22.7	22.1	20.5	12.4	5.2	17.1
Washington	19,952	23.1	25.4	21.7	15.5	2.1	12.2
Oregon	9,272	26.5	23.5	20.7	16.3	7.3	5.7
California	61,766	22.0	20.9	20.1	10.7	5.9	20.4
	WOMEN 16 YEARS AND OVER.						
Pacific division	13,361	15.2	25.9	35.7	18.9	4.2	0.1
Washington	708	42.4	22.9	30.8	3.9		
Oregon	844	19.8	33.8	23.9	22.5		
California	11,809	13.2	25.6	36.9	19.5	4.7	0.1
	CHILDREN UNDER 16 YEARS.						
Pacific division	1,656	21.9	24.0	31.3	20.7	0.3	1.8
Washington	74	50.0	10.8	28.4	10.8		
Oregon	133	30.1	29.3	29.3			11.3
California	1,449	19.7	24.2	31.6	23.1	0.4	1.0

About two-thirds of the wage-earners included in this division were employed in factories reporting fewer than 150 wage-earners annually. If California had not contributed nearly 35 per cent to the number of wage-earners employed in factories having over 150, the division would have presented a showing even more favorable for the smaller establishments.

Oregon was first in the proportion of wage-earners in the very smallest establishments, Washington was second, and California last. More men were employed in the smallest establishments of Oregon than in those of any other of the states of the division, and more women in the smallest establishments of Washington.

Only California is presented by selected industries in Table 72. In Washington the average earnings of men were $14.13; of women, $6.69; of children, $4.26. The industry first in rank in employment of men was lumber and timber products, for which 50.4 per cent of the total for the state was returned. The average earnings were $13.65. The greatest numbers of women and children were returned for confectionery, in which their earnings averaged $5.86 and $3.06. Industries showing the highest averages were—for men, monuments and tombstones, $21.02; for women, flour and grist mill products, jewelry, and optical goods, $10; and for children, boxes, wooden packing, $9. Those showing the lowest averages were—for men, carpets, rag, and optical goods, $10; for women, trunks and valises, $4; and for children, printing and publishing, newspapers and periodicals, $2.50.

The leading industry in Oregon, according to number of wage-earners, was lumber and timber products. The average earnings of men in this industry were $12.33; in the state they were $13.21. The greatest number of women was returned for clothing, men's, in which their compensation averaged $8.30; for the state the average was $7.02. The number of children returned was greatest for canning and preserving, fruits and vegetables, in which their earnings averaged $2.49, the average for the state being $4.54. The industries showing the highest averages were—for men, monuments and tombstones, $21.72; for women, clothing, men's, $8.30; and for children, lumber and timber products, $7.20. The industry showing the lowest average for men, women, and children, was canning and preserving, fruits and vegetables, with earnings averaging $9.83, $3.59, and $2.49, respectively, for these classes of wage-earners.

The 11 industries selected as leading manufactures in California employed 57.2 per cent of the number of wage-earners for the week included in the showing for weekly earnings. Of the greatest number in all establishments in the state, they include a little less than one-half. One industry is represented by nearly three-fourths of all the wage-earners in that industry in the state; for 2 industries more than two-thirds are shown; and for 3, more than one-half. Except 1, which is a little below, all the other selected industries embrace many more than one-third of the wage-earners reported for the state in each industry. Among the selected industries for California, the one showing the highest average earnings for men, $17.16, was printing and publishing, newspapers and periodicals. This was much higher than the average for the state, $14.59, or for the selected industries, $14.64. Six of the other selected industries also reported greater average earnings than the general average. The lowest average for men was $10.50, reported for liquors, vinous. The industry for which the largest number of men was reported was steam railroad repair shops, and the earnings averaged $15.49. The next largest number was reported for lumber and timber products, the earnings averaging $15.09. The average earnings of women were $7.24 in the state and $7.42 for the selected industries, the industry showing the highest, $10.58, being lumber and timber products, and that showing the lowest, $6.27, tobacco, cigars and cigarettes. More women were reported for

canning and preserving, fruits and vegetables, than for any other industry, and their compensation on the average was $7.33. As their number was more than 50 per cent of the total number reported for the state, the effect of their earnings on the general average for the state was most marked. The highest average, $10.58, was reported for lumber and timber products; the lowest, $6, for planing mills. It was in canning and preserving, fruits and vegetables, that children also were employed in largest numbers, their earnings averaging $3.59, an amount somewhat lower than the general average of $3.95 for the selected industries and $4.12 for the state. The highest average, $6.70, was paid in the manufacture of bread and other bakery products, and the lowest, $3.59, in the canning and preserving of fruits and vegetables.

Alaska.—Of the outlying districts, Alaska is the only territory for which statistics are included. Of the total number of establishments employing wage-earners, 24, or nearly one-third, and of the wage-earners, 1,534, or considerably more than one-third, are included in these statistics.

The average earnings of all wage-earners were $13.83; for men, $14.25; for women, $9.07; and for children, $3.62. For women, average earnings were greater than for any other state or territory in the country.

Nearly all, 94.1 per cent, of the wage-earners were men. The proportion of women was 3.7 per cent and of children 2.2 per cent. Practically the only industry shown was that of canning and preserving, fish; engaged in this were 97.3 per cent of the men and practically all the women and children. Average earnings were $14 for men, $8.30 for women, and $3.64 for children. The fact that these averages were lower, except for children, than the averages for the territory shows the effect of the men and women employed in "all other industries," having less than 3 establishments. The average earnings of men in these were $23.15 and of women $30. The returns can not be shown without disclosing individual operations, but it can be stated that the industry for which the highest average earnings were reported both for men and women was that of bread and other bakery products. In no other of these "all other industries" were women employed. The lowest average for men was earned in the printing and publishing of newspapers and periodicals.

The largest factories in the territory for which wage-earners were reported were such as employed an annual average of from 50 to 150 wage-earners. In these establishments 1,039 wage-earners, or 67.7 per cent of the total number, were employed; while in factories having from 10 to 50 wage-earners there were 442, or 28.8 per cent, and in those employing less than 10 wage-earners there were 53, or 3.5 per cent. Of the men, 952, or 65.9 per cent, were in the largest establishments reported for Alaska; 442, or 30.6 per cent, in those of the next largest size; and 50, or 3.5 per cent, in those employing less than 10 wage-earners. Of the women, 54, or 96.4 per cent, and of the children, 33, or 97.1 per cent, were in establishments employing from 50 to 150 wage-earners annually, and of the women, 2, or 3.6 per cent, and of the children, 1, or 2.9 per cent, in those having less than 10 wage-earners.

LARGE AND SMALL ESTABLISHMENTS.

Any investigation of earnings naturally gives rise to a question as to the relation between the size of establishments and the earnings of their employees. In order to show this relation, the number of wage-earners included in these statistics for the United States, with their earnings for a specified week, have been tabulated in one of six groups, according to the size of the establishment as measured by the average number of wage-earners employed during the year. Table 62 shows the result of this tabulation.

TABLE 62.—UNITED STATES—NUMBER OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—AND AMOUNT OF THEIR EARNINGS, CLASSIFIED ACCORDING TO SIZE OF ESTABLISHMENT, WITH PER CENT DISTRIBUTION: 1905.

SIZE OF ESTABLISHMENT.	Number of establishments.	WAGE-EARNERS AND EARNINGS. Total.		Men 16 years and over.		Women 16 years and over.		Children under 16 years.	
		Number.	Earnings.	Number.	Earnings.	Number.	Earnings.	Number.	Earnings.
All establishments	123,703	3,297,819	$33,185,791	2,619,053	$29,240,287	588,599	$3,633,481	90,167	$312,023
Less than 10 wage-earners	97,150	388,883	3,821,341	339,467	3,566,269	41,428	228,749	7,988	26,323
10 to 50 wage-earners	17,055	520,061	5,224,548	423,137	4,682,506	87,332	510,854	9,592	31,188
50 to 150 wage-earners	5,945	625,395	6,312,824	488,952	5,528,338	120,967	732,753	15,476	51,733
150 to 300 wage-earners	2,009	497,060	4,892,576	379,765	4,227,510	99,273	604,867	18,022	60,199
300 to 500 wage-earners	787	353,689	3,571,339	274,156	3,097,155	68,681	436,767	10,852	37,417
500 wage-earners and over	757	912,731	9,363,163	713,576	8,138,509	170,918	1,119,491	28,237	105,163
	PER CENT DISTRIBUTION.								
Less than 10 wage-earners	78.5	11.8	11.5	13.0	12.2	7.0	6.3	8.9	8.4
10 to 50 wage-earners	13.8	15.8	15.8	16.1	16.0	14.8	14.1	10.6	10.0
50 to 150 wage-earners	4.8	18.9	19.0	18.7	18.9	20.6	20.2	17.2	16.6
150 to 300 wage-earners	1.6	15.1	14.7	14.5	14.5	16.9	16.6	20.0	19.3
300 to 500 wage-earners	0.7	10.7	10.8	10.5	10.6	11.7	12.0	12.0	12.0
500 wage-earners and over	0.6	27.7	28.2	27.2	27.8	29.0	30.8	31.3	33.7

The most interesting and significant fact deducible from Table 62 is that the per cent distribution of earnings among the six groups corresponds closely with the per cent distribution of wage-earners—men, women, and children. There is little doubt, however, that study of specific industries would reveal many variations, which offset one another in the aggregate.

The average weekly earnings of the men, women, and children employed in each group of establishments are shown in Table 63.

TABLE 63.—*United States—average weekly earnings of all wage-earners, and of men, women, and children, in large and small establishments: 1905.*

SIZE OF ESTABLISHMENT.	AVERAGE WEEKLY EARNINGS OF—			
	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.
All establishments	$10.06	$11.16	$6.17	$3.46
Less than 10 wage-earners	9.83	10.51	5.52	3.30
10 to 50 wage-earners	10.05	11.07	5.85	3.25
50 to 150 wage-earners	10.09	11.31	6.06	3.34
150 to 300 wage-earners	9.84	11.13	6.09	3.34
300 to 500 wage-earners	10.10	11.30	6.36	3.45
500 wage-earners and over	10.24	11.41	6.55	3.72

As the averages in this table are based on the statistics of wage-earners engaged in various industries, and in all sections of the country, the figures can be accepted only as reflecting general conditions. Character of the industry or occupation, skill, efficiency, cost of living, and social and economic conditions are factors all of which have weight in affecting wages, regardless of the size of the establishment; industrial combinations and trades unions also exert an influence. The statistics indicate that the various factors have tended to equalize the average earnings in establishments of different sizes, but it should not be inferred that the condition indicated by the total for all establishments prevailed in every industry or in all sections of the country. The slight excess of the average earnings in the large establishments over those for the smaller plants may be due to a relatively more complete return from large establishments in those industries in which the earnings are relatively high.

In some states the larger establishments employed a relatively high proportion of wage-earners at the lower earnings, so that the average weekly earnings in the small establishments were in excess of those for the large plants. This was the case especially in Rhode Island, for which certain averages for all wage-earners are presented in Table 64.

In 4 of the industries included in the table the weekly earnings were highest for the small plants, while in the other 4 they were highest either for the medium-sized or for the large establishments. For all industries the average earnings for the small plants were the highest.

TABLE 64.—*Rhode Island—average weekly earnings for selected industries: 1905.*

INDUSTRY.	AVERAGE WEEKLY EARNINGS IN ESTABLISHMENTS GROUPED ACCORDING TO AVERAGE NUMBER OF WAGE-EARNERS EMPLOYED DURING THE YEAR.			
	All establishments.	Less than 50 wage-earners.	50 to 300 wage-earners.	300 wage-earners and over.
All industries	$9.19	$10.34	$9.34	$8.80
Bread and other bakery products	11.21	11.07	12.50	....
Cotton goods	7.19	6.67	7.27	7.19
Dyeing and finishing textiles	8.41	9.90	7.85	8.82
Electrical machinery, apparatus, and supplies	7.11	9.03	8.28	6.35
Foundry and machine shop products	11.81	12.24	11.31	12.02
Jewelry	10.62	10.30	10.65	11.66
Woolen goods	9.09	9.15	8.75	9.48
Worsted goods	8.48	8.33	9.62	8.19

Table 65 gives the number and percentage of men, women, and children employed in the United States in each class of selected establishments, by size, classified by weekly earnings.

The per cent distribution shows that in the case of men the size of the establishment had but little effect upon earnings. For each class more than 30 per cent of the men received between $10 and $15 per week, the group receiving from $10 to $12 leading in establishments employing 500 wage-earners and over, and the group receiving from $12 to $15, in each of the other classes, the superiority of this group of earnings increasing as the size of the establishment decreased except in the class having 150 to 300 wage-earners.

For each class the greatest percentage of women is found in one of the three groups of earnings between $4 and $7. For establishments employing less than 10 wage-earners the proportion receiving from $6 to $7 was somewhat greater than that receiving from $4 to $5. With the exception of this class the proportion of women in the higher groups of earnings increases as a rule with the increase in the size of establishments. The proportion receiving from $4 to $5 was greatest for establishments employing between 10 and 50 wage-earners; that receiving from $5 to $6 was greatest for establishments employing from 150 to 300 wage-earners and 500 wage-earners and over; and that receiving from $6 to $7 was greatest for establishments employing 500 wage-earners and over.

For each class of establishments the proportion of children in the low groups of earnings is so great that it is difficult to make comparisons. In each class over four-fifths of the children received less than $5. In establishments employing 500 wage-earners and over the greatest proportion received from $3 to $4; for each class employing less than 500 wage-earners the greatest proportion received less than $3.

TABLE 65.—UNITED STATES—NUMBER AND PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—BY CLASSIFIED WEEKLY EARNINGS AND SIZE OF ESTABLISHMENT: 1905.

[Size of establishment determined by the average number of wage-earners employed during the year.]

WEEKLY EARNINGS.	NUMBER OF WAGE-EARNERS IN EACH CLASS OF ESTABLISHMENTS.						PER CENT DISTRIBUTION.					
	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
	MEN 16 YEARS AND OVER.											
Total	339,467	423,137	488,952	379,765	274,156	713,576	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	5,283	10,852	12,061	9,029	5,572	13,549	1.6	2.6	2.5	2.4	2.0	1.9
$3 to $4	8,657	11,020	11,746	8,871	5,294	12,009	2.6	2.6	2.4	2.3	1.9	1.7
$4 to $5	13,450	15,737	17,344	13,672	8,561	18,975	4.0	3.7	3.5	3.6	3.1	2.7
$5 to $6	13,968	18,992	18,494	15,742	10,732	25,501	4.1	4.5	3.8	4.1	3.9	3.6
$6 to $7	29,001	27,535	28,750	23,861	15,320	37,473	8.5	6.5	5.9	6.3	5.6	5.2
$7 to $8	27,543	31,029	34,779	29,665	20,392	53,573	8.1	7.3	7.1	7.8	7.4	7.5
$8 to $9	19,327	26,998	37,917	33,994	23,983	65,735	5.7	6.4	7.8	9.0	8.8	9.2
$9 to $10	47,152	54,634	63,976	48,033	37,775	92,242	13.9	12.9	13.1	12.7	13.8	12.9
$10 to $12	48,331	59,023	73,529	59,232	44,325	125,043	14.2	13.9	15.0	15.6	16.2	17.5
$12 to $15	63,157	73,462	82,905	61,128	47,452	122,464	18.6	17.4	17.0	16.1	17.3	17.2
$15 to $20	50,513	67,197	73,583	52,786	38,252	103,316	14.9	15.9	15.0	13.9	14.0	14.5
$20 to $25	10,332	19,148	22,418	14,962	10,476	28,710	3.0	4.5	4.6	3.9	3.8	4.0
$25 and over	2,753	7,510	11,450	8,790	6,022	14,986	0.8	1.8	2.3	2.3	2.2	2.1
Earnings for the specified week:												
Total	$3,566,269	$4,682,506	$5,528,338	$4,227,510	$3,097,155	$8,138,509						
Average per wage-earner	$10.51	$11.07	$11.31	$11.13	$11.30	$11.41						
	WOMEN 16 YEARS AND OVER.											
Total	41,428	87,332	120,967	99,273	68,681	170,918	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	3,498	8,173	10,479	7,937	4,648	9,123	8.4	9.3	8.7	8.0	6.8	5.3
$3 to $4	6,243	11,237	14,727	11,488	7,734	12,741	15.1	12.9	12.2	11.6	11.3	7.5
$4 to $5	7,189	14,356	19,447	15,466	10,231	21,968	17.4	16.4	16.1	15.6	14.9	12.9
$5 to $6	7,015	14,114	18,700	16,591	10,659	28,595	16.9	16.2	15.4	16.7	15.5	16.7
$6 to $7	7,240	13,818	18,957	16,098	11,025	30,173	17.5	15.8	15.7	16.2	16.1	17.7
$7 to $8	3,783	8,822	13,208	10,902	7,578	23,899	9.1	10.1	10.9	11.0	11.0	14.0
$8 to $9	2,392	5,996	8,526	7,122	5,525	17,609	5.8	6.9	7.0	7.2	8.0	10.3
$9 to $10	1,524	4,013	6,286	5,180	4,328	12,719	3.7	4.6	5.2	5.2	6.3	7.4
$10 to $12	1,525	3,826	6,046	4,788	3,848	9,600	3.7	4.4	5.0	4.8	5.6	5.6
$12 to $15	751	2,094	3,041	2,642	2,197	3,569	1.8	2.4	2.5	2.6	3.2	2.1
$15 and over	268	883	1,550	1,059	908	[illegible]	0.6	1.0	1.3	1.1	1.3	0.5
Earnings for the specified week:												
Total	$228,749	$510,854	$732,753	$604,867	$436,767	$1,119,491						
Average per wage-earner	$5.52	$5.85	$6.06	$6.09	$6.36	$6.55						
	CHILDREN UNDER 16 YEARS.											
Total	7,988	9,592	15,476	18,022	10,852	28,237	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	3,009	3,739	6,239	6,858	4,018	7,997	37.7	39.0	40.3	38.0	37.0	28.3
$3 to $4	2,457	3,079	4,673	6,165	3,449	8,813	30.7	32.1	30.2	34.2	31.8	31.2
$4 to $5	1,311	1,721	2,666	3,183	1,976	7,048	16.4	17.9	17.2	17.7	18.2	25.0
$5 to $6	596	572	1,060	1,141	776	2,915	7.5	6.0	6.9	6.3	7.2	10.3
$6 to $7	401	311	543	514	442	1,069	5.0	3.2	3.5	2.9	4.1	3.8
$7 to $8	109	[illegible]	162	100	110	262	1.4	1.0	1.0	0.6	1.0	0.9
$8 and over	105	74	133	61	81	133	1.3	0.8	0.9	0.3	0.7	0.5
Earnings for the specified week:												
Total	$26,323	$31,188	$51,733	$60,199	$37,417	$105,163						
Average per wage-earner	$3.30	$3.25	$3.34	$3.34	$3.45	$3.72						

Unfortunately the statistics collected for this report are not sufficiently detailed to permit of a presentation by occupations—which would afford a basis for conclusions concerning conditions governing the same occupation in establishments of different sizes.

The division of occupations and processes which is a natural result of the development of large manufacturing enterprises, may have given rise to the belief that there is a tendency to employ a larger proportion of low-priced labor in large establishments than in small. Such a conclusion would be based on the theory that the earnings of a machine hand engaged in one of the various processes, which in a large shop are contributory to the finished product, are less than the earnings of a skilled machinist performing in a small shop all the various operations necessary to the same product. For instance, in the clothing industry the work of the large establishments is divided into a number of occupations, such as those of shrinkers, cutters, pocket cutters, trimmers, buttonhole makers, sleevemakers, collarmakers, etc.; and it would seem that employees engaged in these occupations would require less skill, and therefore receive smaller earnings, than the employees of small establishments similarly engaged, who must possess sufficient skill to perform many or all of these operations.

It is to be observed, however, that although there is less individualism in the work of the large factories

than of the small, the nice adjustment of the different processes required to produce the perfection displayed in some of the large modern establishments makes it necessary to secure a high degree of efficiency in each occupation. In the large establishment skill is associated with a process, while in the small shop it is associated with the completed article.

That there is an increasing supervisory force required in large establishments is indicated by the fact that the number of salaried officials, superintendents, etc., reported at the census of 1905, showed an increase of 42.7 per cent over the number returned at the census of 1900, while there was an increase of only 16 per cent in the average number of wage-earners employed during the year. As a result, the ratio of wage-earners to salaried employees decreased from nearly 13 in 1900 to 10.5 in 1905. It is possible that, in large establishments engaged in some industries, those mechanics who are most proficient and therefore command the highest wages are gradually passing into the supervisory force, and thus are included by the census in the group of salaried employees instead of among wage-earners. But even if this tendency exists, the number that has passed from the wage to the salaried class can hardly be sufficient to affect appreciably the large totals involved in the statistics of weekly earnings.

The character of the products and the location of the factories should always be considered in connection with a classification of establishments to determine the relative earnings of employees. This is especially true of the classification by size of establishments. If, for example, all or a majority of the selected establishments employing 300 wage-earners and over, which are shown for any of the 5 industries given in Table 66, were located in states where the prevailing wages were relatively high, and the majority of the other establishments were in the Southern states, where the general average earnings were comparatively low, the statistics would necessarily indicate that the largest earnings were made by employees in the large factories. The number of hours per day that the establishments were in operation should also be considered in this connection. Notwithstanding the limitations of the statistics, however, some information can be derived from a study of the proportion of the wage-earners (in the different groups of earnings) reported for establishments of varying size in the same industry. The manufacture of cotton goods; furniture; lumber and timber products; printing and publishing, book and job; and tobacco, cigars and cigarettes, have been selected to illustrate this use of the statistics.

TABLE 66.—FIVE SELECTED INDUSTRIES—NUMBER AND PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—IN ESTABLISHMENTS ACCORDING TO SIZE, BY GEOGRAPHIC DIVISIONS AND CLASSIFIED WEEKLY EARNINGS: 1905.

COTTON GOODS.

[No establishments were reported for the Western division.]

GEOGRAPHIC DIVISION AND WEEKLY EARNINGS.	NUMBER OF WAGE-EARNERS IN EACH CLASS OF ESTABLISHMENTS.						PER CENT DISTRIBUTION.					
	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
GEOGRAPHIC DIVISION.												
Men 16 years and over	98	1,547	6,755	13,820	14,237	58,568	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic	71	739	2,448	5,713	8,084	47,727	72.5	47.8	36.2	41.3	56.8	81.5
South Atlantic	21	585	3,728	7,046	5,336	8,826	21.4	37.8	55.2	51.0	37.5	15.1
North Central	6	38	181	189	76	....	6.1	2.4	2.7	1.4	0.5	....
South Central	....	185	398	872	741	2,015	....	12.0	5.9	6.3	5.2	3.4
Women 16 years and over	82	1,570	5,236	10,792	11,535	52,722	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic	74	972	2,056	4,888	7,317	45,149	90.2	61.9	39.3	45.3	63.4	85.6
South Atlantic	8	439	2,645	4,945	3,294	5,939	9.8	28.0	50.5	45.8	28.6	11.3
North Central	....	48	274	308	243	....	....	3.0	5.2	2.9	2.1	....
South Central	....	111	261	651	681	1,634	....	7.1	5.0	6.0	5.9	3.1
Children under 16 years	15	618	2,926	5,746	3,863	12,081	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic	2	121	330	915	1,281	6,185	13.3	19.6	11.3	15.9	33.2	51.2
South Atlantic	13	350	2,299	4,215	2,086	4,834	86.7	56.6	78.5	73.4	54.0	40.0
North Central	....	....	20	33	25	....	....	....	0.7	0.6	0.6	....
South Central	....	147	277	583	471	1,062	....	23.8	9.5	10.1	12.2	8.8

Table 66.—FIVE SELECTED INDUSTRIES—NUMBER AND PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—IN ESTABLISHMENTS ACCORDING TO SIZE, BY GEOGRAPHIC DIVISIONS AND CLASSIFIED WEEKLY EARNINGS: 1905—Continued.

COTTON GOODS—Continued.

GEOGRAPHIC DIVISION AND WEEKLY EARNINGS.	NUMBER OF WAGE-EARNERS IN EACH CLASS OF ESTABLISHMENTS.						PER CENT DISTRIBUTION.					
	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
WEEKLY EARNINGS.												
Men 16 years and over	98	1,547	6,755	13,820	14,237	58,568	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	4	115	428	934	780	1,666	4.1	7.4	6.3	6.7	5.5	2.9
$3 to $4	6	106	753	1,173	1,061	2,019	6.1	6.9	11.2	8.5	7.5	3.5
$4 to $5	2	208	1,259	2,103	1,792	4,430	2.0	13.4	18.6	15.2	12.6	7.6
$5 to $6	10	170	781	1,879	1,653	6,347	10.2	11.0	11.6	13.6	11.6	10.8
$6 to $7	2	222	995	2,193	2,198	8,622	2.0	14.4	14.7	15.9	15.4	14.7
$7 to $8	6	127	628	1,463	1,584	9,025	6.1	8.2	9.3	10.6	11.1	15.4
$8 to $9	12	127	427	951	1,353	6,322	12.3	8.2	6.3	6.9	9.5	10.8
$9 to $10	6	116	456	909	1,205	5,752	6.1	7.5	6.8	6.6	8.5	9.8
$10 to $12	22	115	401	959	1,186	6,864	22.5	7.4	5.9	6.9	8.3	11.7
$12 to $15	24	156	311	767	968	4,765	24.5	10.1	4.6	5.5	6.8	8.1
$15 to $20	4	74	253	372	335	1,829	4.1	4.8	3.7	2.7	2.4	3.1
$20 to $25	....	10	44	78	92	649	....	0.6	0.7	0.6	0.6	1.1
$25 and over	....	1	19	39	30	278	....	0.1	0.3	0.3	0.2	0.5
Earnings for the specified week:												
Total	$899	$11,515	$45,502	$94,947	$102,546	$476,896	....	....	....	....	....	....
Average per wage-earner	$9.17	$7.44	$6.74	$6.87	$7.20	$8.14	....	....	....	....	....	....
Women 16 years and over	82	1,570	5,236	10,792	11,535	52,722	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	3	163	623	1,138	1,022	2,160	3.7	10.4	11.9	10.6	8.9	4.1
$3 to $4	8	297	1,273	1,958	1,656	3,405	9.7	18.9	24.3	18.1	14.4	6.5
$4 to $5	13	351	1,087	2,339	1,714	6,444	15.9	22.4	20.8	21.7	14.9	12.2
$5 to $6	10	208	837	1,790	1,897	8,963	12.2	13.3	16.0	16.6	16.4	17.0
$6 to $7	23	228	689	1,555	1,870	10,496	28.0	14.5	13.1	14.4	16.2	19.9
$7 to $8	13	123	334	975	1,363	8,546	15.9	7.8	6.4	9.0	11.8	16.2
$8 to $9	7	101	230	564	1,031	6,167	8.5	6.4	4.4	5.2	8.9	11.7
$9 to $10	....	49	103	278	618	3,864	....	3.1	2.0	2.6	5.4	7.3
$10 to $12	5	37	44	154	304	2,448	6.1	2.4	0.8	1.4	2.6	4.7
$12 to $15	....	10	15	38	55	225	....	0.6	0.3	0.4	0.5	0.4
$15 and over	....	3	1	3	5	4	....	0.2	(1)	(1)	(1)	(1)
Earnings for the specified week:												
Total	$468	$8,168	$25,107	$55,131	$66,079	$339,165	....	....	....	....	....	....
Average per wage-earner	$5.71	$5.20	$4.80	$5.11	$5.73	$6.43	....	....	....	....	....	....
Children under 16 years	15	618	2,926	5,746	3,863	12,081	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	10	391	1,964	2,992	2,008	4,042	66.7	63.3	67.1	52.1	52.0	33.5
$3 to $4	3	163	684	1,909	1,065	3,773	20.0	26.4	23.4	33.2	27.6	31.2
$4 to $5	2	43	221	628	484	2,787	13.3	6.9	7.6	10.9	12.5	23.1
$5 to $6	....	16	51	177	161	973	....	2.6	1.7	3.1	4.2	8.1
$6 to $7	....	2	6	34	86	392	....	0.3	0.2	0.6	2.2	3.2
$7 to $8	....	3	....	6	28	73	....	0.5	....	0.1	0.7	0.6
$8 and over	....	....	....	....	31	41	....	....	....	....	0.8	0.3
Earnings for the specified week:												
Total	$33	$1,650	$7,622	$16,740	$12,339	$42,771	....	....	....	....	....	....
Average per wage-earner	$2.20	$2.67	$2.60	$2.91	$3.19	$3.54	....	....	....	....	....	....

[1] Less than one-tenth of 1 per cent.

FURNITURE.

GEOGRAPHIC DIVISION.												
Men 16 years and over	2,776	12,696	18,370	11,533	3,358	4,982	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic	1,356	5,320	5,938	3,993	674	2,260	48.9	41.9	32.3	34.6	20.1	45.4
South Atlantic	184	1,217	2,322	619	....	....	6.6	9.6	12.6	5.4	....	....
North Central	883	5,109	8,678	6,107	2,684	2,722	31.8	40.3	47.3	53.0	79.9	54.6
South Central	77	524	1,032	814	....	....	2.8	4.1	5.6	7.0	....	....
Western	276	526	400	....	....	....	9.9	4.1	2.2	....	....	....
Women 16 years and over	59	382	413	206	302	549	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic	39	148	117	105	23	545	66.1	38.7	28.3	51.0	7.6	99.3
South Atlantic	....	35	3	....	....	....	....	9.2	0.7	....	....	....
North Central	15	179	240	101	279	4	25.4	46.9	58.1	49.0	92.4	0.7
South Central	....	9	39	....	....	....	....	2.3	9.5	....	....	....
Western	5	11	14	....	....	....	8.5	2.9	3.4	....	....	....
Children under 16 years	27	224	448	378	64	151	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic	6	47	72	32	9	141	22.2	21.0	16.1	8.5	14.1	93.4
South Atlantic	3	64	162	90	....	....	11.1	28.6	36.1	23.8	....	....
North Central	9	84	159	206	55	10	33.4	37.5	35.5	54.5	85.9	6.6
South Central	8	23	55	50	....	....	29.6	10.2	12.3	13.2	....	....
Western	1	6	....	....	....	....	3.7	2.7	....	....	....	....

TABLE 66.—FIVE SELECTED INDUSTRIES—NUMBER AND PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—IN ESTABLISHMENTS ACCORDING TO SIZE, BY GEOGRAPHIC DIVISIONS AND CLASSIFIED WEEKLY EARNINGS: 1905—Continued.

FURNITURE—Continued.

GEOGRAPHIC DIVISION AND WEEKLY EARNINGS.	NUMBER OF WAGE-EARNERS IN EACH CLASS OF ESTABLISHMENTS.						PER CENT DISTRIBUTION.					
	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
WEEKLY EARNINGS.												
Men 16 years and over	2,776	12,696	18,370	11,533	3,358	4,982	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	21	258	466	139	6	34	0.7	2.0	2.5	1.2	0.2	0.7
$3 to $4	60	343	501	193	34	76	2.2	2.7	2.7	1.7	1.0	1.5
$4 to $5	74	484	854	480	89	122	2.7	3.8	4.6	4.2	2.6	2.4
$5 to $6	85	597	914	536	110	172	3.1	4.7	5.0	4.6	3.3	3.5
$6 to $7	193	885	1,466	876	272	291	7.0	7.0	8.0	7.6	8.1	5.8
$7 to $8	187	1,181	2,098	1,305	429	414	6.7	9.3	11.4	11.3	12.8	8.3
$8 to $9	116	1,033	1,594	1,471	506	559	4.2	8.1	8.7	12.8	15.1	11.2
$9 to $10	254	1,480	2,509	1,695	645	795	9.1	11.7	13.7	14.7	19.2	16.0
$10 to $12	366	1,969	2,767	1,699	681	663	13.2	15.5	15.1	14.7	20.3	13.3
$12 to $15	646	2,325	3,102	1,911	374	1,004	23.3	18.3	16.9	16.6	11.1	20.2
$15 to $20	622	1,612	1,738	1,007	171	809	22.4	12.7	9.4	8.7	5.1	16.2
$20 to $25	140	420	273	171	25	34	5.0	3.3	1.5	1.5	0.7	0.7
$25 and over	12	109	88	50	16	9	0.4	0.9	0.5	0.4	0.5	0.2
Earnings for the specified week:												
Total	$32,324	$132,409	$179,492	$114,129	$31,758	$55,681	....	....	....	....	....	....
Average per wage-earner	$11.64	$10.43	$9.77	$9.90	$9.46	$11.18	....	....	....	....	....	....
Women 16 years and over	59	382	413	206	302	549	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	2	77	157	6	20	....	3.4	20.2	38.0	2.9	6.6	....
$3 to $4	5	98	55	21	61	31	8.5	25.7	13.3	10.2	20.2	5.6
$4 to $5	8	52	50	35	69	38	13.5	13.6	12.1	17.0	22.9	6.9
$5 to $6	15	48	37	61	77	116	25.4	12.6	9.0	29.6	25.5	21.1
$6 to $7	6	35	40	29	44	107	10.2	9.2	9.7	14.1	14.6	19.5
$7 to $8	10	28	36	18	16	101	16.9	7.3	8.7	8.7	5.3	18.4
$8 to $9	6	12	16	15	4	66	10.2	3.1	3.9	7.3	1.3	12 0
$9 to $10	2	10	10	6	2	36	3.4	2.6	2.4	2.9	0.7	6.6
$10 to $12	1	12	7	6	4	31	1.7	3.1	1.7	2.9	1.3	5.7
$12 to $15	2	9	3	2	4	23	3.4	2.3	0.7	1.0	1.3	4.2
$15 and over	2	1	2	7	1	....	3.4	0.3	0.5	3.4	0.3	....
Earnings for the specified week:												
Total	$383	$1,763	$1,775	$1,263	$1,624	$3,769	....	....	....	....	....	....
Average per wage-earner	$6.49	$4.62	$4.30	$6.13	$5.38	$6.87	....	....	....	....	....	....
Children under 16 years	27	224	448	378	64	151	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	12	83	176	102	11	10	44.5	37.0	39.3	27.0	17.3	6.6
$3 to $4	6	77	154	150	20	18	22.2	34.4	34.4	39.7	31.2	11.9
$4 to $5	4	41	88	104	16	16	14.8	18.3	19.7	27.5	25.0	10.6
$5 to $6	4	15	15	22	9	89	14.8	6.7	3.3	5.8	14.1	59.0
$6 to $7	1	8	15	....	4	15	3.7	3.6	3.3	....	6.2	9.9
$7 to $8	....	....	....	....	4	2	....	....	....	....	6.2	1.3
$8 and over	....	....	....	....	....	1	....	....	....	....	....	0.7
Earnings for the specified week:												
Total	$93	$711	$1,460	$1,319	$263	$739	....	....	....	....	....	....
Average per wage-earner	$3.44	$3.17	$3.26	$3.49	$4.11	$4.89	....	....	....	....	....	....

LUMBER AND TIMBER PRODUCTS.

GEOGRAPHIC DIVISION.	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
Men 16 years and over	42,601	38,864	35,159	28,320	14,083	16,691	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic	10,790	7,055	5,770	2,893	170	1,210	25.3	18.1	16.4	10.2	1.2	7.2
South Atlantic	9,996	7,074	5,406	5,331	2,345	1,607	23.5	18.2	15.4	18.8	16.6	9.6
North Central	8,616	10,495	10,855	7,667	4,986	3,830	20.2	27.0	30.9	27.1	35.4	23.0
South Central	9,903	9,553	7,651	7,339	3,627	7,109	23.3	24.6	21.7	25.9	25.8	42.6
Western	3,296	[1]4,687	5,477	5,090	2,955	2,935	7.7	[1]12.1	15.6	18.0	21.0	17.6
Women 16 years and over	43	116	79	56	8	....	100.0	100.0	100.0	100.0	100.0	....
North Atlantic	17	39	8	12	....	....	39.5	33.6	10.1	21.4	....	....
South Atlantic	....	15	....	....	....	....	....	12.9	....	....	....	....
North Central	2	41	31	44	5	....	4.7	35.3	39.3	78.6	62.5	....
South Central	....	9	34	....	3	....	....	7.8	43.0	....	37.5	....
Western	24	12	6	....	....	....	55.8	10.4	7.6	....	....	....
Children under 16 years	123	320	229	223	29	78	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic	16	32	11	....	....	3	13.0	10.0	4.8	....	....	3.9
South Atlantic	46	95	65	70	10	....	37.4	29.7	28.4	31.4	34.5	....
North Central	19	40	78	96	8	21	15.4	12.5	34.1	43.0	27.6	26.9
South Central	29	144	75	30	11	16	23.6	45.0	32.7	13.5	37.9	20.5
Western	13	9	....	27	....	38	10.6	2.8	....	12.1	....	48.7

[1] Includes Alaska.

TABLE 66.—FIVE SELECTED INDUSTRIES—NUMBER AND PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—IN ESTABLISHMENTS ACCORDING TO SIZE, BY GEOGRAPHIC DIVISIONS AND CLASSIFIED WEEKLY EARNINGS: 1905—Continued.

LUMBER AND TIMBER PRODUCTS—Continued.

GEOGRAPHIC DIVISION AND WEEKLY EARNINGS.	NUMBER OF WAGE-EARNERS IN EACH CLASS OF ESTABLISHMENTS.						PER CENT DISTRIBUTION.					
	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
WEEKLY EARNINGS.												
Men 16 years and over	42,601	38,864	35,159	28,320	14,083	16,691	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	954	1,584	1,948	1,116	613	1,805	2.2	4.1	5.5	3.9	4.3	10.8
$3 to $4	1,405	1,190	931	768	320	547	3.3	3.1	2.6	2.7	2.3	3.3
$4 to $5	3,649	1,760	1,106	945	411	551	8.6	4.5	3.1	3.3	2.9	3.3
$5 to $6	2,188	2,015	1,357	1,342	404	471	5.1	5.2	3.9	4.7	2.9	2.8
$6 to $7	7,763	4,312	3,019	2,413	814	882	18.2	11.1	8.6	8.5	5.8	5.3
$7 to $8	6,362	4,850	3,301	2,310	1,316	1,793	14.9	12.5	9.4	8.2	9.3	10.7
$8 to $9	2,038	2,622	2,587	2,378	1,416	1,731	4.8	6.7	7.4	8.4	10.0	10.4
$9 to $10	9,751	7,751	6,812	4,887	2,375	1,720	22.9	19.9	19.4	17.3	16.9	10.3
$10 to $12	2,971	4,385	5,430	5,180	1,704	2,786	7.0	11.3	15.4	18.3	12.1	16.7
$12 to $15	3,470	4,478	4,914	3,414	2,714	2,323	8.1	11.5	14.0	12.1	19.3	13.9
$15 to $20	1,730	2,795	2,413	2,529	1,531	1,337	4.1	7.2	6.9	8.9	10.9	8.0
$20 to $25	254	815	916	573	258	480	0.6	2.1	2.6	2.0	1.8	2.9
$25 and over	66	307	425	465	207	265	0.2	0.8	1.2	1.7	1.5	1.6
Earnings for the specified week:												
Total	$343,601	$355,834	$340,173	$283,652	$145,395	$157,083						
Average per wage-earner	$8.07	$9.16	$9.68	$10.02	$10.32	$9.41						
Women 16 years and over	43	116	79	56	8		100.0	100.0	100.0	100.0	100.0	
Less than $3	1	5	30	10	3		2.3	4.3	38.0	17.8	37.5	
$3 to $4	13	11	33				30.2	9.5	41.7			
$4 to $5	5	21	4	10			11.6	18.1	5.0	17.9		
$5 to $6	6	22	1	14			14.0	19.0	1.3	25.0		
$6 to $7	3	28	4	10	5		7.0	24.1	5.0	17.9	62.5	
$7 to $8	6	7	3	12			14.0	6.0	3.8	21.4		
$8 to $9	1	1	1				2.3	0.9	1.3			
$9 to $10	1	11	1				2.3	9.5	1.3			
$10 to $12	4		1				9.3		1.3			
$12 to $15	2	8	1				4.7	6.9	1.3			
$15 and over	1	2					2.3	1.7				
Earnings for the specified week:												
Total	$262	$711	$281	$284	$39							
Average per wage-earner	$6.09	$6.13	$3.56	$5.07	$4.88							
Children under 16 years	123	320	229	223	29	78	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	49	152	68	36	5	21	39.9	47.5	29.7	16.1	17.2	26.9
$3 to $4	33	99	66	97	6	24	26.8	31.0	28.8	43.5	20.7	30.8
$4 to $5	11	41	65	71	6	17	8.9	12.8	28.4	31.8	20.7	21.8
$5 to $6	11	13	18	4	4	1	8.9	4.1	7.9	1.8	13.8	1.3
$6 to $7	11	10	4	13	1	11	8.9	3.1	1.7	5.8	3.5	14.1
$7 to $8	5	2	6	1	5	1	4.1	0.6	2.6	0.5	17.2	1.3
$8 and over	3	3	2	1	2	3	2.5	0.9	0.9	0.5	6.9	3.8
Earnings for the specified week:												
Total	$450	$999	$828	$861	$142	$318						
Average per wage-earner	$3.66	$3.12	$3.62	$3.86	$4.90	$4.08						

PRINTING AND PUBLISHING, BOOK AND JOB.

GEOGRAPHIC DIVISION.	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
Men 16 years and over	12,767	11,855	7,329	4,365	1,326	1,703	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic	5,869	5,152	3,273	1,978	1,126	759	46.0	43.5	44.7	45.3	84.9	44.6
South Atlantic	1,016	974	283	181			7.9	8.2	3.9	4.1		
North Central	4,058	4,472	2,789	1,461	200	944	31.8	37.7	38.0	33.5	15.1	55.4
South Central	767	410	537	616			6.0	3.5	7.3	14.1		
Western	1,057	847	447	129			8.3	7.1	6.1	3.0		
Women 16 years and over	1,863	3,435	3,121	1,879	913	777	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic	765	1,349	1,310	1,000	740	290	41.1	39.3	42.0	53.2	81.1	37.3
South Atlantic	129	313	167	40			6.9	9.1	5.3	2.1		
North Central	785	1,463	1,291	549	173	487	42.1	42.6	41.4	29.2	18.9	62.7
South Central	80	112	189	247			4.3	3.2	6.1	13.2		
Western	104	198	164	43			5.6	5.8	5.2	2.3		
Children under 16 years	727	417	227	174	6	32	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic	264	134	103	42	6		36.3	32.1	45.4	24.1	100.0	
South Atlantic	102	38	9	14			14.0	9.1	4.0	8.1		
North Central	200	165	89	70		32	27.5	39.6	39.2	40.2		100.0
South Central	82	26	22	48			11.3	6.2	9.7	27.6		
Western	79	54	4				10.9	13.0	1.7			

TABLE 66.—FIVE SELECTED INDUSTRIES—NUMBER AND PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—IN ESTABLISHMENTS ACCORDING TO SIZE, BY GEOGRAPHIC DIVISIONS AND CLASSIFIED WEEKLY EARNINGS: 1905—Continued.

PRINTING AND PUBLISHING, BOOK AND JOB—Continued.

GEOGRAPHIC DIVISION AND WEEKLY EARNINGS.	NUMBER OF WAGE-EARNERS IN EACH CLASS OF ESTABLISHMENTS.						PER CENT DISTRIBUTION.					
	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
WEEKLY EARNINGS.												
Men 16 years and over	12,767	11,855	7,329	4,365	1,326	1,703	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	220	177	109	77	11	321	1.7	1.5	1.5	1.8	0.8	18.8
$3 to $4	582	414	233	136	34	62	4.6	3.5	3.2	3.1	2.6	3.6
$4 to $5	610	562	280	193	59	60	4.8	4.8	3.8	4.4	4.5	3.5
$5 to $6	732	477	222	149	40	40	5.7	4.0	3.0	3.4	3.0	2.4
$6 to $7	904	544	311	133	35	34	7.1	4.6	4.3	3.0	2.6	2.0
$7 to $8	793	631	306	139	23	56	6.2	5.3	4.2	3.2	1.7	3.3
$8 to $9	693	582	376	186	38	46	5.4	4.9	5.1	4.3	2.9	2.7
$9 to $10	1,027	748	328	170	72	72	8.0	6.3	4.5	3.9	5.4	4.2
$10 to $12	1,489	1,114	604	333	112	93	11.7	9.4	8.2	7.6	8.5	5.5
$12 to $15	2,294	1,850	932	534	279	144	18.0	15.6	12.7	12.2	21.0	8.5
$15 to $20	2,674	3,151	2,162	1,212	308	358	20.9	26.6	29.5	27.8	23.2	21.0
$20 to $25	588	1,103	965	754	188	226	4.6	9.3	13.2	17.3	14.2	13.3
$25 and over	161	502	501	349	127	191	1.3	4.2	6.8	8.0	9.6	11.2
Earnings for the specified week:												
Total	$140,949	$153,783	$104,148	$65,640	$20,253	$24,401						
Average per wage-earner	$11.04	$12.97	$14.21	$15.04	$15.27	$14.33						
Women 16 years and over	1,863	3,435	3,121	1,879	913	777	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	93	238	235	124	40	130	5.0	6.9	7.5	6.6	4.4	16.7
$3 to $4	265	384	362	218	36	48	14.2	11.2	11.6	11.6	3.9	6.2
$4 to $5	290	496	479	232	57	54	15.5	14.4	15.4	12.3	6.2	7.0
$5 to $6	292	597	433	276	133	77	15.7	17.4	13.9	14.7	14.6	9.9
$6 to $7	327	618	488	242	115	54	17.5	18.0	15.6	12.9	12.6	7.0
$7 to $8	203	409	403	188	169	142	10.9	11.9	12.9	10.0	18.5	18.3
$8 to $9	118	236	244	197	101	95	6.3	6.9	7.8	10.5	11.1	12.2
$9 to $10	96	145	121	119	42	31	5.2	4.2	3.9	6.3	4.6	4.0
$10 to $12	92	168	160	141	103	39	4.9	4.9	5.1	7.5	11.3	5.0
$12 to $15	57	90	114	82	67	50	3.1	2.6	3.7	4.4	7.3	6.4
$15 and over	31	54	82	60	50	57	1.7	1.6	2.6	3.2	5.5	7.3
Earnings for the specified week:												
Total	$11,229	$20,850	$19,885	$12,727	$7,529	$6,213						
Average per wage-earner	$6.03	$6.07	$6.37	$6.77	$8.25	$8.00						
Children under 16 years	727	417	227	174	6	32	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	205	86	35	53	1		28.2	20.6	15.4	30.5	16.7	
$3 to $4	277	180	112	79	5	8	38.1	43.2	49.3	45.4	83.3	25.0
$4 to $5	133	87	55	28		24	18.3	20.9	24.2	16.1		75.0
$5 to $6	66	31	16	14			9.1	7.4	7.1	8.0		
$6 to $7	27	15	6				3.7	3.6	2.7			
$7 to $8	9	11	2				1.2	2.6	0.9			
$8 and over	10	7	1				1.4	1.7	0.4			
Earnings for the specified week:												
Total	$2,541	$1,513	$828	$573	$20	$122						
Average per wage-earner	$3.50	$3.63	$3.65	$3.29	$3.33	$3.81						

TOBACCO, CIGARS AND CIGARETTES.

GEOGRAPHIC DIVISION.	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
Men 16 years and over	20,767	7,794	4,959	4,071	3,697	5,392	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic	8,813	3,565	2,334	1,490	1,186	4,511	42.4	45.7	47.1	36.6	32.1	83.6
South Atlantic	1,032	955	1,161	1,960	1,967	726	5.0	12.3	23.4	48.2	53.2	13.5
North Central	9,229	2,833	1,164	604	465	102	44.5	36.3	23.5	14.8	12.6	1.9
South Central	544	187	146	17	79	53	2.6	2.4	2.9	0.4	2.1	1.0
Western	1,149	254	154				5.5	3.3	3.1			
Women 16 years and over	3,844	3,678	4,140	4,227	6,433	12,052	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic	2,225	1,702	1,845	1,975	3,520	9,522	57.9	46.3	44.6	46.7	54.7	79.0
South Atlantic	94	445	737	1,025	764	1,600	2.4	12.1	17.8	24.3	11.9	13.3
North Central	1,359	1,403	1,293	982	1,752	436	35.4	38.1	31.2	23.2	27.2	3.6
South Central	48	77	210	245	397	494	1.2	2.1	5.1	5.8	6.2	4.1
Western	118	51	55				3.1	1.4	1.3			
Children under 16 years	1,064	264	222	547	249	892	100.0	100.0	100.0	100.0	100.0	100.0
North Atlantic	235	79	70	248	169	371	22.1	29.9	31.5	45.3	67.9	41.6
South Atlantic	62	24	44	175		317	5.8	9.1	19.8	32.0		35.5
North Central	635	131	107	60	80	82	59.7	49.6	48.2	11.0	32.1	9.2
South Central	74	25		64		122	7.0	9.5		11.7		13.7
Western	58	5	1				5.4	1.9	0.5			

TABLE 66.—FIVE SELECTED INDUSTRIES—NUMBER AND PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—IN ESTABLISHMENTS ACCORDING TO SIZE, BY GEOGRAPHIC DIVISIONS AND CLASSIFIED WEEKLY EARNINGS: 1905—Continued.

TOBACCO, CIGARS AND CIGARETTES—Continued.

GEOGRAPHIC DIVISION AND WEEKLY EARNINGS.	NUMBER OF WAGE-EARNERS IN EACH CLASS OF ESTABLISHMENTS.						PER CENT DISTRIBUTION.					
	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.	Less than 10 wage-earners.	10 to 50 wage-earners.	50 to 150 wage-earners.	150 to 300 wage-earners.	300 to 500 wage-earners.	500 wage-earners and over.
WEEKLY EARNINGS.												
Men 16 years and over	20,767	7,794	4,959	4,071	3,697	5,392	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	602	220	87	115	44	176	2.9	2.8	1.8	2.8	1.2	3.3
$3 to $4	794	259	111	113	50	408	3.8	3.3	2.2	2.8	1.3	7.6
$4 to $5	747	293	166	140	91	488	3.6	3.8	3.4	3.4	2.5	9.0
$5 to $6	894	351	169	190	112	637	4.3	4.5	3.4	4.7	3.0	11.8
$6 to $7	1,065	353	235	229	220	569	5.1	4.5	4.7	5.6	5.9	10.6
$7 to $8	1,026	397	265	264	153	388	5.0	5.1	5.3	6.5	4.1	7.2
$8 to $9	1,297	502	347	207	191	407	6.3	6.4	7.0	5.1	5.2	7.5
$9 to $10	1,580	582	391	302	280	335	7.6	7.5	7.9	7.4	7.6	6.2
$10 to $12	4,134	1,210	636	463	699	351	19.9	15.5	12.8	11.4	18.9	6.5
$12 to $15	5,301	1,754	990	679	842	682	25.5	22.5	20.0	16.7	22.8	12.6
$15 to $20	2,892	1,502	1,071	857	781	696	13.9	19.3	21.6	21.0	21.1	12.9
$20 to $25	353	292	361	329	143	176	1.7	3.8	7.3	8.1	3.9	3.3
$25 and over	83	79	130	183	91	79	0.4	1.0	2.6	4.5	2.5	1.5
Earnings for the specified week:												
Total	$218,141	$89,199	$62,376	$51,749	$45,370	$53,193	....	....	....	....	....	....
Average per wage-earner	$10.50	$11.44	$12.58	$12.71	$12.27	$9.87	....	....	....	....	....	....
Women 16 years and over	3,844	3,678	4,140	4,227	6,433	12,052	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	624	506	351	492	641	1,165	16.2	13.8	8.5	11.6	10.0	9.7
$3 to $4	775	489	469	419	642	1,564	20.2	13.3	11.3	9.9	10.0	13.0
$4 to $5	647	605	655	809	879	1,981	16.8	16.4	15.8	19.1	13.7	16.4
$5 to $6	572	680	659	748	916	1,953	14.9	18.5	15.9	17.7	14.2	16.2
$6 to $7	431	511	616	635	847	1,761	11.2	13.9	14.9	15.0	13.2	14.6
$7 to $8	294	315	466	431	570	1,723	7.6	8.6	11.3	10.2	8.9	14.3
$8 to $9	170	195	285	304	478	746	4.4	5.3	6.9	7.2	7.4	6.2
$9 to $10	103	107	174	142	478	486	2.7	2.9	4.2	3.4	7.4	4.0
$10 to $12	130	170	266	122	433	454	3.4	4.6	6.4	2.9	6.7	3.8
$12 to $15	75	75	126	82	374	209	2.0	2.0	3.0	2.0	5.8	1.7
$15 and over	23	25	73	43	175	10	0.6	0.7	1.8	1.0	2.7	0.1
Earnings for the specified week:												
Total	$19,190	$20,264	$25,798	$24,325	$43,927	$71,728	....	....	....	....	....	....
Average per wage-earner	$4.99	$5.50	$6.23	$5.75	$6.83	$5.95	....	....	....	....	....	....
Children under 16 years	1,064	264	222	547	249	892	100.0	100.0	100.0	100.0	100.0	100.0
Less than $3	549	155	143	262	132	408	51.6	58.7	64.4	47.9	53.0	45.7
$3 to $4	333	79	48	156	80	218	31.3	29.9	21.6	28.5	32.1	24.4
$4 to $5	103	23	21	62	29	150	9.7	8.7	9.4	11.3	11.7	16.8
$5 to $6	40	6	8	47	4	79	3.8	2.3	3.6	8.6	1.6	8.9
$6 to $7	21	....	1	18	4	29	2.0	....	0.5	3.3	1.6	3.3
$7 to $8	7	1	1	2	....	7	0.6	0.4	0.5	0.4	....	0.8
$8 and over	11	....	....	....	....	1	1.0	....	....	....	....	0.1
Earnings for the specified week:												
Total	$3,041	$731	$639	$1,745	$653	$2,902	....	....	....	....	....	....
Average per wage-earner	$2.86	$2.77	$2.88	$3.19	$2.62	$3.25	....	....	....	....	....	....

A description of the statistics for cotton goods will illustrate the use of the figures for the 5 industries in Table 66. The classification includes some small establishments which use very little power-driven machinery. These establishments are included in the two groups that employed less than 50 wage-earners. The highest average weekly earnings for men and the greatest proportions of them in the higher earnings groups are shown for establishments employing less than 10 wage-earners, but the small number of wage-earners involved, 98, detracts from the importance of the figures. The majority of the men, as well as of the women, reported for this group were employed in establishments located in the North Atlantic states, and most of them were in Philadelphia, Pa. They were engaged in the production of products that are made largely without the use of machinery, and in the manufacture of some finer grades of goods that can be produced with advantage on a small scale.

As some of the establishments included in the group employing 10 to 50 wage-earners are properly classed as factories, this group may be considered, with the four groups of larger size, as representative of the factory industry. The average earnings of men, women, and children are highest for the largest factories, which gave employment to 61 per cent of the wage-earners reported for the industry. The high earnings in these large establishments are due to the large proportion of wage-earners reported from the mills in the North Atlantic states, where the higher wages prevailed.

While the third highest average weekly earnings, $7.44, are shown for men in the factories employing from 10 to 50 wage-earners, the greatest concentration at rates in excess of $7 per week, is shown for the mills that employed 500 wage-earners and over. A large proportion of the men in both of these groups is shown for mills in the North Atlantic states. Mills that employed from 50 to 150 wage-earners reported the lowest earnings; of the wage-earners in this group, more than one-half of the men and women and more than three-fourths of the children were reported from the South Atlantic states.

TABLE 67.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY SPECIFIED INDUSTRIES—NUMBER OF WAGE-ALL WAGE-EARNERS AND OF EACH CLASS, AVERAGE NUMBER OF MEN, WOMEN, AND CHILDREN

	INDUSTRY.	Number of establishments.	AVERAGE NUMBER OF WAGE-EARNERS.			TOTAL.	
			Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Earnings.	Number.
1	All industries	123,703	2,124,069	488,832	73,855	$33,185,791	3,297,819
2	Agricultural implements	362	22,885	109	113	338,090	31,016
3	Ammunition	9	696	525	20	12,301	1,430
4	Artificial feathers and flowers	90	197	1,290	26	14,321	2,135
5	Artificial limbs	67	222	10	7	3,419	268
6	Artificial stone	333	1,290			24,420	2,348
7	Artists' materials	12	49	24	4	670	92
8	Automobile bodies and parts	31	634	4	2	9,778	890
9	Automobiles	86	7,836	3	29	141,419	10,849
10	Awnings, tents, and sails	265	1,050	761	20	28,177	2,735
11	Axle grease	18	81	10	1	1,039	112
12	Babbitt metal and solder	42	221	6		3,765	353
13	Bags, other than paper	34	651	1,460	76	15,831	2,557
14	Bags, paper	28	416	373	1	6,733	914
15	Baking and yeast powders	102	621	532	18	12,616	1,391
16	Baskets, and rattan and willow ware	242	1,790	369	76	22,131	2,969
17	Beet sugar	19	1,589	1	14	77,117	5,174
18	Bells	13	318	32	8	3,616	372
19	Belting and hose, leather	84	1,273	20	1	16,970	1,482
20	Belting and hose, linen	11	65	153	12	1,701	251
21	Belting and hose, rubber	9	1,944	244	45	24,916	2,575
22	Bicycles and tricycles	69	1,190	7	11	19,100	1,622
23	Billiard tables and materials	35	274	14	4	3,907	337
24	Blacking	88	245	307	21	5,587	700
25	Bluing	31	55	30	4	763	107
26	Bone, ivory, and lamp black	14	64	4		1,019	84
27	Bookbinding and blank book making	526	4,363	4,121	320	88,830	9,914
28	Boot and shoe cut stock	232	2,965	1,383	175	43,049	5,370
29	Boot and shoe findings	154	1,739	1,106	86	26,313	3,570
30	Boot and shoe uppers	55	134	52	2	2,021	220
31	Boots and shoes	745	51,419	26,033	2,221	941,674	92,002
32	Boots and shoes, rubber	19	8,294	6,095	369	161,807	16,174
33	Boxes, cigar	150	1,247	1,268	92	20,743	2,863
34	Boxes, fancy and paper	389	4,958	9,437	1,009	118,153	17,660
35	Boxes, wooden packing	548	12,684	683	593	147,711	17,159
36	Brass	8	41			550	47
37	Brass and copper, rolled	18	7,750	310	33	106,903	9,230
38	Brass castings and brass finishing	329	5,601	95	57	79,750	7,067
39	Brassware	135	4,919	1,518	159	80,865	7,650
40	Bread and other bakery products	13,493	44,322	8,341	1,064	624,602	59,079
41	Brick and tile	2,053	24,681	8	395	404,698	41,703
42	Bronze castings	20	543	11	6	8,083	648
43	Brooms and brushes	765	3,810	1,700	220	53,702	6,921
44	Butter	3,333	5,880	90	11	77,998	7,136
45	Butter, reworking	23	262	8	1	3,762	337
46	Buttons	119	2,435	2,114	167	41,741	5,806
47	Calcium lights	14	25	3		309	31
48	Candles	9	261	97	20	3,289	410
49	Canning and preserving, fish	196	2,545	826	198	90,170	8,370
50	Canning and preserving, fruits and vegetables	598	4,631	5,872	559	278,440	41,063
51	Canning and preserving, oysters	13	105	33	1	1,655	294
52	Card cutting and designing	36	164	125	7	2,861	348
53	Carpets and rugs, other than rag	36	5,135	4,080	516	89,602	10,512
54	Carpets, rag	225	641	184	22	9,184	1,158
55	Carriage and wagon materials	346	8,544	146	151	102,220	10,701
56	Carriages and sleds, children's	40	1,591	73	26	18,574	2,020
57	Carriages and wagons	3,433	34,108	505	297	448,841	41,978
58	Cars and general shop construction and repairs by steam railroad companies	713	162,719	397	86	2,267,677	182,042
59	Cars and general shop construction and repairs by street railroad companies	43	6,129	18	3	84,622	6,752
60	Cars, steam railroad, not including operations of railroad companies	46	28,984	96	22	528,952	47,249
61	Cars, street railroad, not including operations of railroad companies	8	2,737	5	28	47,298	3,861
62	Cash registers and calculating machines	15	2,979	392	4	44,147	3,836
63	Cement	67	10,998	6	40	148,895	13,838
64	Charcoal	39	177		6	2,280	292
65	Cheese	2,226	2,223	37	4	33,105	3,083
66	Chemicals	155	9,620	597	21	120,249	11,396
67	China decorating	12	36	45	1	957	100
68	Chocolate and cocoa products	11	615	346	6	10,763	1,285
69	Cleansing and polishing preparations	84	241	116	2	3,794	449
70	Clocks	26	2,616	1,231	179	47,449	4,239
71	Cloth, sponging and refinishing	21	170			2,324	187
72	Clothing, horse	12	95	142		2,203	287
73	Clothing, men's	1,697	16,573	24,062	670	402,605	47,344
74	Clothing, men's, buttonholes	92	247	177	11	4,128	478
75	Clothing, women's	1,072	10,225	21,009	310	363,135	40,312
76	Coffee and spice, roasting and grinding	278	1,774	1,137	44	30,699	3,367
77	Coffins, burial cases, and undertakers' goods	137	3,620	737	41	47,223	4,766
78	Coke	120	11,885		46	161,609	15,720
79	Collars and cuffs	9	991	5,105	69	52,360	6,527
80	Combs	22	577	65	22	7,724	843
81	Condensed milk	48	1,358	738	48	22,667	2,455

ARNERS—MEN, WOMEN, AND CHILDREN—IN EACH GROUP OF EARNINGS, WITH EARNINGS AND NUMBER OF MPLOYED DURING THE YEAR, AND NUMBER OF ESTABLISHMENTS: 1905.

		MEN 16 YEARS AND OVER (DISTRIBUTION OF NUMBER BY EARNINGS).													
Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	
$29,240,287	2,619,053	56,346	57,597	87,739	103,429	161,940	196,981	207,954	343,812	409,483	450,568	385,647	106,046	51,511	1
336,653	30,679	419	459	757	909	1,596	2,312	3,414	4,887	4,982	5,638	4,197	907	202	2
8,487	797	7	1	20	44	37	112	37	206	88	98	119	18	10	3
2,764	256	7	10	14	12	14	16	17	42	40	37	30	11	6	4
3,315	250	2	9	2	6	7	8	11	20	32	58	69	21	5	5
24,397	2,343	16	216	20	68	55	120	82	573	406	467	160	142	18	6
513	58		1	8	3	5	4	14	4	5	11	2		1	7
9,710	879	1	21	36	36	44	66	78	82	153	190	135	22	15	8
141,168	10,805	59	55	110	180	220	354	427	1,320	2,251	2,604	2,596	477	152	9
20,732	1,600	5	18	17	29	66	43	59	145	203	416	511	86	2	10
976	96		6	18	1	3	5	2	7	20	18	11	4	1	11
3,724	347	1	3	1	1	19	62	45	53	35	60	55	7	5	12
7,505	742	8	17	44	46	63	42	41	125	128	140	74	12	2	13
4,565	469	9	27	13	40	38	23	29	127	69	45	30	15	4	14
8,638	729	5	4	22	19	37	60	41	72	102	180	166	20	1	15
19,177	2,326	135	76	147	133	229	257	303	431	283	225	91	13	3	16
76,650	5,124	21	7	3	7	9	13	28	146	310	2,835	1,372	230	143	17
3,365	329	3	2	14	12	22	36	28	54	58	60	34	2	4	18
16,819	1,457	6	16	34	55	64	95	87	179	235	380	246	46	14	19
795	68			1	4	3	4	4	7	12	18	12	1	2	20
22,732	2,201	7	40	78	104	139	196	285	288	384	406	236	35	3	21
18,968	1,599	12	16	57	52	72	112	156	126	292	312	311	75	6	22
3,815	316			2	4	8	2	9	37	87	85	67	14	1	23
3,343	289	1	5	15	15	14	14	16	30	31	88	44	9	7	24
545	61		2	4	3	7	5	11	11	7	4	6	1		25
1,001	80	1				13			7	4	37	13	5		26
58,576	4,830	45	163	263	294	329	259	273	325	523	749	1,134	369	104	27
34,152	3,547	47	100	142	199	271	336	313	390	618	751	316	56	8	28
18,240	2,097	75	89	120	189	214	212	202	231	279	322	133	22	9	29
1,540	159	7	3	10	11	5	22	8	13	28	27	23	2		30
702,713	59,142	1,004	1,446	2,094	2,594	3,557	3,900	4,077	5,319	8,609	11,565	10,811	3,046	1,120	31
103,653	9,006	75	88	197	172	378	527	573	1,649	1,605	1,781	1,629	278	54	32
12,212	1,361	33	70	75	109	138	128	129	153	215	212	87	15	2	33
54,564	5,484	117	226	318	414	457	386	430	586	890	846	619	149	46	34
140,382	15,525	349	485	1,136	1,079	1,304	1,587	1,501	2,410	2,329	2,149	1,029	137	30	35
550	47							2	20	8	6	8	3		36
104,529	8,847	105	65	129	120	250	396	600	2,353	1,853	1,507	941	322	206	37
78,895	6,900	116	157	193	224	378	377	498	695	1,336	1,143	1,548	194	41	38
69,881	5,896	67	109	199	209	339	330	409	909	820	1,041	1,039	268	157	39
567,464	48,230	382	740	1,014	1,615	2,396	2,278	2,760	3,622	7,834	13,323	10,528	1,416	322	40
401,604	40,881	1,240	796	1,242	1,237	2,746	3,497	3,728	9,220	7,384	6,181	2,677	615	318	41
7,980	624	4	13	23	22	29	43	50	66	109	103	88	35	39	42
43,988	4,581	110	184	249	261	442	372	365	524	760	798	412	76	28	43
77,134	6,977	79	107	143	268	414	561	542	657	1,201	1,614	1,179	152	60	44
3,711	328	10	7	3	1	6	5	26	45	100	80	26	13	5	45
28,257	3,034	98	119	142	216	291	296	310	383	396	387	322	57	17	46
289	28				5	3		3	5	1	7	3	1		47
2,742	279	5	9	2	12	20	6	22	68	77	39	14	5		48
68,376	5,557	64	35	84	112	180	205	447	641	713	1,441	1,053	444	138	49
152,718	16,717	1,309	557	545	752	1,380	1,724	1,260	3,165	2,259	2,396	1,110	194	66	50
1,336	213	28	34	82	36	24	9	8	5	15	15	7			51
1,979	188	4	10	10	10	12	13	10	19	28	39	22	8	3	52
54,875	5,525	69	48	185	329	438	788	686	655	862	878	462	81	44	53
7,813	871	6	29	48	36	82	101	90	162	142	139	35		1	54
100,542	10,350	247	231	439	465	925	1,140	979	1,543	1,683	1,609	936	117	36	55
17,820	1,886	36	49	68	90	159	201	268	278	337	240	152	3	5	56
443,854	40,981	641	691	1,080	1,224	2,300	3,116	2,756	6,325	6,687	8,839	6,206	898	218	57
2,264,168	181,531	1,526	1,142	2,364	3,127	6,468	9,249	16,062	23,071	33,184	35,894	35,485	11,120	2,839	58
84,481	6,731	103	56	100	119	124	221	282	625	1,057	2,300	1,559	149	36	59
527,726	47,060	1,919	893	937	1,095	1,593	2,250	3,976	9,861	8,003	7,335	6,616	1,793	789	60
47,089	3,814	64	57	108	100	144	205	234	497	622	759	677	248	99	61
41,248	3,406	70	54	97	200	152	179	267	297	397	666	793	179	55	62
148,539	13,765	150	250	196	298	1,104	1,529	1,823	1,655	2,268	2,702	1,422	303	65	63
2,253	282	5	22	20	15	27	12	5	98	70	7	1			64
32,721	3,002	18	30	76	140	190	297	220	284	609	586	412	109	25	65
116,551	10,680	106	85	111	137	213	473	991	2,575	2,488	2,090	1,157	185	69	66
641	42			2	1	2	2	2	1	2	7	11	8	4	67
8,110	767	6	20	15	12	10	31	26	49	50	447	81	18	2	68
3,061	291	3	11	15	10	26	15	18	34	54	50	45	5	5	69
36,930	2,751	7	19	42	68	111	128	161	224	382	615	840	118	36	70
2,324	187		4	7	12	11	5	12	16	27	40	34	10	9	71
1,053	116		22	7	8	5	7	13	7	20	12	13	2		72
233,527	19,095	171	418	591	759	989	1,146	1,290	1,462	2,855	3,479	3,674	1,769	492	73
2,994	278		5	6	27	13	20	14	28	58	72	25	8	2	74
178,577	13,205	79	157	206	379	541	701	935	1,166	2,024	2,517	2,423	1,219	858	75
23,078	1,955	21	31	36	44	63	105	130	180	387	525	323	73	37	76
42,052	3,928	57	98	149	131	271	253	262	513	717	794	596	69	18	77
161,307	15,648	299	266	368	538	920	935	1,687	1,881	4,409	3,101	1,003	190	51	78
11,010	1,078	36	54	82	87	98	92	64	87	147	135	127	33	36	79
6,940	710	9	18	24	47	46	66	61	92	133	165	42	5	2	80
16,684	1,533	27	21	21	36	44	67	87	289	431	342	133	23	12	81

TABLE 67.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY SPECIFIED INDUSTRIES—NUMBER OF WAGE-ALL WAGE-EARNERS AND OF EACH CLASS, AVERAGE NUMBER OF MEN, WOMEN, AND CHILDREN

	INDUSTRY.	Number of establishments.	AVERAGE NUMBER OF WAGE-EARNERS.			TOTAL.	
			Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Earnings.	Number.
82	Confectionery	816	6,265	8,826	778	$138,258	20,455
83	Cooperage	932	10,223	12	148	134,304	13,641
84	Coppersmithing and sheet iron working	1,263	10,521	85	69	181,934	14,157
85	Cordage and twine	57	3,259	2,566	515	52,950	7,693
86	Cordials and sirups	41	134	56	1	3,024	507
87	Cork, cutting	25	409	273	111	5,883	948
88	Corsets	57	500	4,210	111	38,143	5,349
89	Cotton goods	525	86,023	74,036	22,339	1,307,578	202,211
90	Cotton small wares	40	892	1,431	163	20,114	2,700
91	Cotton waste	20	252	139		3,619	441
92	Crucibles	8	202			2,519	234
93	Cutlery and edge tools	129	5,785	544	159	75,372	7,331
94	Dairymen's, poulterers', and apiarists' supplies	98	987	146	14	13,257	1,513
95	Dentists' materials	44	300	210	24	5,865	564
96	Drug grinding	16	622	126	1	8,110	807
97	Druggists' preparations	134	1,286	1,735	67	24,592	3,393
98	Dyeing and finishing textiles	179	14,458	3,063	680	175,890	20,195
99	Dyestuffs and extracts	57	1,260	3	3	15,769	1,707
100	Electrical machinery, apparatus, and supplies	443	24,753	6,146	400	364,509	36,875
101	Electroplating	229	1,022	40	31	16,186	1,389
102	Emery wheels	24	617	10	1	8,455	720
103	Enameling and enameled goods	54	833	378	38	12,760	1,497
104	Engravers' materials	7	37			504	39
105	Engraving and diesinking	182	760	32	31	13,106	956
106	Engraving, steel, including plate printing	116	771	349	48	16,249	1,352
107	Engraving, wood	49	121	1	4	2,083	162
108	Envelopes	36	825	1,989	106	25,011	3,176
109	Explosives	28	661	28		11,280	842
110	Fancy articles, not elsewhere specified	172	1,601	1,266	99	30,952	3,742
111	Felt goods	18	1,470	297	3	15,634	2,015
112	Fertilizers	200	7,332	71	17	105,059	14,361
113	Files	42	1,902	188	90	23,274	2,340
114	Firearms	20	4,510	36	34	60,803	5,109
115	Fire extinguishers, chemical	26	100	1		1,491	122
116	Fireworks	19	288	188	6	4,902	662
117	Flags and banners	16	40	100	2	1,092	191
118	Flavoring extracts	219	512	443	12	9,335	1,233
119	Flax and hemp, dressed	7	54			639	110
120	Flour and grist mill products	7,382	25,516	135	48	309,069	30,931
121	Food preparations	445	2,892	1,854	67	52,763	6,406
122	Foundry and machine shop products	5,359	202,174	1,628	1,045	2,901,465	246,177
123	Foundry supplies	25	171	11	2	2,214	219
124	Fur goods	448	1,833	1,499	20	52,578	4,647
125	Furnishing goods, men's	230	918	6,677	139	61,208	9,246
126	Furniture	1,257	47,016	1,578	1,051	560,955	56,918
127	Furs, dressed	28	356	14	5	7,388	523
128	Galvanizing	22	419		10	5,971	581
129	Gas and lamp fixtures	148	3,020	814	200	50,390	4,728
130	Gas, illuminating and heating	619	13,408	24	5	193,239	18,150
131	Gas machines and meters	59	1,365	88	3	19,405	1,607
132	Glass	171	23,070	1,324	2,280	466,343	36,368
133	Glass, cutting, staining, and ornamenting	264	3,454	331	97	51,985	4,664
134	Gloves and mittens, leather	136	1,685	2,082	60	40,793	5,133
135	Glucose	8	2,477	56	14	46,086	3,882
136	Glue	37	1,272	163	20	16,444	1,760
137	Gold and silver, leaf and foil	42	176	181	6	3,798	378
138	Gold and silver, reducing and refining, not from the ore	28	141	1		2,047	154
139	Graphite and graphite refining	6	40	4		470	46
140	Grease and tallow	228	1,962	4	3	24,774	2,228
141	Grindstones	10	254			3,976	385
142	Gypsum wall plaster	102	2,048	20	4	29,754	2,862
143	Hairwork	69	69	241	3	2,643	343
144	Hammocks	3	4	2		79	12
145	Hand knit goods	33	29	121	3	1,259	211
146	Hand stamps	143	543	80	52	8,240	757
147	Hardware	237	12,385	1,626	395	154,489	16,069
148	Hardware, saddlery	46	862	83	13	10,458	1,043
149	Hat and cap materials	33	622	183	28	7,249	947
150	Hats and caps, other than felt, straw, and wool	197	1,737	892	26	33,513	3,179
151	Hats, felt	118	7,241	2,916	345	129,933	11,524
152	Hats, straw	28	1,058	1,949	35	37,558	4,351
153	Hats, wool	7	406	163	5	8,945	963
154	Hones and whetstones	9	37			468	61
155	Horseshoes	3	99		1	1,816	157
156	Hosiery and knit goods	416	10,481	26,485	3,855	293,843	45,347
157	House furnishing goods, not elsewhere specified	125	955	971	45	19,777	2,361
158	Ice, manufactured	829	4,896	8	18	83,625	7,731
159	Ink, printing	45	434	5	4	5,411	452
160	Ink, writing	24	173	193	8	3,269	443
161	Instruments, professional and scientific	134	1,480	157	43	19,564	1,851
162	Iron and steel, blast furnaces	82	18,105	1	38	278,981	23,839
163	Iron and steel, bolts, nuts, washers, and rivets, not made in rolling mills or steel works	52	3,724	583	119	47,591	4,765
164	Iron and steel, doors and shutters	15	330			5,490	421
165	Iron and steel forgings	78	3,202		11	51,736	4,017
166	Iron and steel, nails and spikes, cut and wrought, including wire nails, not made in rolling mills or steel works.	54	1,873	542	32	27,081	2,786

EARNERS—MEN, WOMEN, AND CHILDREN—IN EACH GROUP OF EARNINGS, WITH EARNINGS AND NUMBER OF EMPLOYED DURING THE YEAR, AND NUMBER OF ESTABLISHMENTS: 1905—Continued.

MEN 16 YEARS AND OVER (DISTRIBUTION OF NUMBER BY EARNINGS).															
Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	
$78,002	7,595	109	255	400	482	846	773	595	694	1,005	1,121	924	265	126	82
133,399	13,376	382	319	541	763	1,034	1,586	1,041	1,642	2,095	2,010	1,565	313	85	83
181,010	13,972	199	214	353	422	589	785	744	1,470	1,434	2,124	3,641	1,857	140	84
34,335	4,076	43	98	293	316	456	827	681	422	374	282	255	24	5	85
1,611	153		2	4	6	10	29	15	9	19	36	17	5	1	86
4,012	496		21	101	41	45	51	43	58	71	40	22	1	2	87
8,885	523	2	4	11	26	14	15	15	51	63	144	94	46	38	88
732,305	95,025	3,927	5,118	9,794	10,840	14,232	12,833	9,192	8,444	9,547	6,991	2,867	873	367	89
9,608	951	10	57	64	46	79	103	77	106	113	166	80	30	20	90
2,882	282	3			5	15	18	33	108	63	22	13	2		91
2,519	234	3	2	3	4	5	12	28	61	57	40	10	8	1	92
70,097	6,397	137	112	227	317	398	484	506	654	958	1,362	978	205	59	93
12,209	1,290	10	127	62	51	78	145	109	157	165	254	116	13	3	94
4,400	323	1	3	3	15	6	12	13	23	36	82	95	20	14	95
7,563	675			6	5	14	20	28	309	140	92	42	11	8	96
14,072	1,407	11	33	62	105	130	139	130	190	211	175	174	28	19	97
152,134	15,996	143	240	425	752	1,391	3,367	2,096	2,103	2,719	1,584	682	175	319	98
15,734	1,697	38	35	21	75	298	182	131	351	300	186	56	17	7	99
317,338	29,240	901	669	905	1,286	1,459	1,900	2,673	2,956	4,437	5,868	4,789	1,074	323	100
15,705	1,301	5	27	46	59	57	63	50	90	173	288	389	45	8	101
8,390	709	7	7	10	19	29	39	48	111	129	158	130	19	3	102
9,640	949	13	17	17	25	72	130	138	106	199	106	96	23	7	103
504	30			1	2			4	2	6	12	9	2	1	104
12,742	881	21	24	36	34	40	29	23	31	74	124	229	144	72	105
13,491	868	12	35	34	41	36	38	32	49	54	122	192	101	122	106
2,068	158	5	12	7	12	8	4	7	5	13	14	33	22	15	107
10,572	875	2	25	24	31	40	46	45	95	125	177	204	54	7	108
11,105	810	20	12	13	18	14	36	72	95	73	187	138	48	84	109
21,262	1,902	46	117	136	117	153	155	88	167	194	256	263	116	94	110
13,608	1,689	19	16	26	35	105	277	589	257	164	120	62	14	5	111
104,425	14,233	924	813	954	1,987	2,353	1,848	1,290	1,083	1,699	879	317	69	17	112
21,637	2,057	21	44	59	116	164	155	218	244	358	456	170	31	21	113
60,464	5,040	49	45	88	158	303	420	432	499	905	923	917	201	100	114
1,483	121				6	2	13	9	9	24	24	21	10	3	115
3,487	382	16	11	22	49	32	48	28	31	55	52	26	10	2	116
422	55	1	6	6	3	5	8	7	11	2	2	4			117
6,354	615	11	19	36	38	46	33	38	55	100	108	91	31	9	118
639	110	12	12	19	19	18	8	2	18	2					119
307,718	30,684	380	539	923	966	3,211	3,007	1,956	5,455	5,484	5,079	2,877	559	248	120
38,827	3,782	66	73	85	149	276	290	287	545	840	725	344	74	28	121
2,884,406	242,845	3,455	4,699	6,273	6,815	10,429	14,748	18,377	30,823	36,340	45,523	51,180	10,903	3,280	122
2,165	208	6	3	3	8	9	12	10	51	43	38	19	6		123
34,223	2,499	9	28	53	90	113	119	174	187	319	461	507	229	210	124
12,316	1,090	17	35	60	78	70	70	71	74	186	152	187	58	32	125
545,793	53,715	924	1,207	2,103	2,414	3,983	5,614	5,279	7,378	8,145	9,362	5,959	1,063	284	126
7,242	500	3	5	5	8	16	24	24	49	75	87	109	36	59	127
5,906	570	11	13	6	22	7	21	146	82	122	90	40	10		128
43,604	3,507	27	93	165	158	258	149	156	243	376	742	809	242	89	129
193,038	18,118	1,021	426	446	362	884	758	989	3,364	3,275	3,460	2,697	346	90	130
18,895	1,518	13	27	35	57	64	52	95	133	228	374	350	83	7	131
444,361	31,510	562	772	1,469	1,657	1,696	1,828	1,968	3,357	4,026	3,630	3,448	2,378	4,719	132
49,417	4,153	20	180	230	210	224	243	192	252	430	859	993	255	65	133
22,516	2,190	50	48	86	85	156	189	184	341	357	405	231	50	8	134
45,257	3,750	58	16	33	42	63	63	43	646	1,006	1,188	436	129	27	135
15,275	1,527	26	30	32	20	55	66	145	487	284	255	98	24	5	136
2,630	185		5	8	6	6	8	8	5	12	12	94	18	3	137
2,040	153				1	2	2	1	14	29	54	40	7	3	138
454	42						1		24	7	7	2		1	139
24,737	2,221	37	16	23	15	69	97	142	342	590	613	242	27	8	140
3,976	385	3	2			4	1	21	206	98	26	24			141
29,489	2,819	135	47	65	78	152	121	134	497	790	428	310	41	21	142
886	75			6	3	5	5	5	6	11	18	14	1	1	143
54	6				1	1				3	1				144
295	38			4	7	9	1	5	1	7	2	2			145
7,339	606	3	28	35	33	34	24	24	41	65	106	148	48	17	146
142,886	13,776	157	342	554	663	1,079	1,340	1,221	1,660	2,278	2,512	1,647	259	64	147
9,909	940	3	31	57	49	57	73	84	106	170	143	132	26	9	148
5,987	688	5	4	27	46	143	112	111	66	84	56	26	8		149
25,537	2,009	8	10	40	135	80	67	98	111	297	471	519	117	56	150
105,228	7,929	44	141	245	275	344	476	432	685	954	1,507	1,673	766	387	151
15,425	1,357	12	15	63	52	73	98	101	191	221	287	143	68	33	152
7,430	680	31	19	48	31	40	51	102	91	54	77	61	57	18	153
460	58	1	4	5	5	3	5		28	3	3	1			154
1,805	155			1	12	25	21	8	13	18	21	23	8	5	155
102,843	11,558	326	414	683	782	1,447	1,608	1,417	1,288	1,544	1,072	669	205	103	156
11,546	1,171	9	23	55	73	95	118	134	201	167	165	99	22	10	157
83,488	7,680	204	138	174	263	547	563	566	748	1,481	1,804	846	240	106	158
5,362	443	1	5	15	11	8	17	14	43	88	151	65	16	9	159
1,965	200		12	18	10	9	15	16	22	29	41	21	2	5	160
18,411	1,634	14	59	90	87	115	98	106	110	189	315	340	79	32	161
278,752	23,796	362	164	262	252	553	1,193	1,174	2,549	7,383	6,385	2,756	610	153	162
43,358	3,977	39	40	91	192	429	276	276	679	553	628	644	109	12	163
5,490	421	2		1	10	24	31	17	34	55	63	110	66	8	164
51,677	4,004	48	38	58	97	140	224	224	526	720	821	673	269	166	165
23,190	2,127	65	42	61	75	112	267	247	200	297	275	383	67	36	166

TABLE 67.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY SPECIFIED INDUSTRIES—NUMBER OF WAGE-ALL WAGE-EARNERS AND OF EACH CLASS, AVERAGE NUMBER OF MEN, WOMEN, AND CHILDREN

	INDUSTRY.	Number of establishments.	AVERAGE NUMBER OF WAGE-EARNERS. Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.
167	Iron and steel pipe, wrought	12	2,187	19		$28,780	2,897
168	Iron and steel, steel works and rolling mills	192	96,794	852	574	1,482,872	119,069
169	Ivory and bone work	39	874	207	47	12,009	1,371
170	Japanning	24	261	113	7	4,315	473
171	Jewelry	657	9,461	3,555	313	184,506	15,783
172	Jewelry and instrument cases	55	310	345	9	5,818	762
173	Jute and jute goods	7	1,722	2,362	318	29,648	4,592
174	Kaolin and ground earths	76	978	27		11,970	1,331
175	Labels and tags	36	548	307	28	8,239	977
176	Lamps and reflectors	73	2,025	498	43	30,249	2,925
177	Lapidary work	34	149	9	6	4,172	204
178	Lard, refined	6	325	14	11	3,561	353
179	Lasts	42	818	1	1	14,580	974
180	Lead, bar, pipe, and sheet	25	481			7,025	555
181	Leather goods	212	1,481	646	172	24,668	2,816
182	Leather, tanned, curried, and finished	621	33,025	1,061	548	389,187	40,259
183	Lime	284	3,559	1	7	42,396	4,756
184	Linen goods	8	611	829	174	11,724	1,692
185	Liquors, distilled	575	3,454	163	17	53,394	5,439
186	Liquors, malt	918	24,937	324	204	401,999	28,446
187	Liquors, vinous	255	726	33	4	20,572	2,036
188	Lithographing and engraving	120	5,417	1,074	97	95,316	7,195
189	Locomotives	11	23,040		60	390,041	31,349
190	Looking-glass and picture frames	298	3,465	302	126	46,602	4,742
191	Lumber and timber products	8,394	114,896	202	652	1,630,913	177,022
192	Lumber, planing mill products, including sash, doors, and blinds	2,866	40,426	164	360	561,392	50,787
193	Malt	85	996			20,077	1,428
194	Mantels, slate, marble, and marbleized	4	87			1,327	96
195	Marble and stone work	626	20,697	59	41	373,024	28,317
196	Matches	7	707	419	17	9,279	1,283
197	Mats and matting	3	228			2,075	282
198	Mattresses and spring beds	420	3,129	838	74	46,110	4,995
199	Millinery and lace goods	344	1,548	7,719	131	106,388	13,328
200	Mineral and soda waters	2,542	6,851	78	217	91,139	9,552
201	Mirrors	61	957	22	7	13,778	1,196
202	Models and patterns, not including paper patterns	362	1,462	74	22	30,099	2,159
203	Monuments and tombstones	1,009	6,268	6	6	108,327	7,882
204	Mucilage and paste	76	255	51	11	3,747	396
205	Musical instruments and materials, not specified	99	1,355	85	51	20,428	1,746
206	Musical instruments, organs	57	1,915	64	5	26,424	2,244
207	Musical instruments, pianos	125	9,965	241	182	142,583	11,394
208	Musical instruments, piano and organ materials	62	4,230	271	200	58,775	5,101
209	Needles, pins, and hooks and eyes	21	267	299	17	5,160	631
210	Nets and seines	5	57	585	23	4,221	715
211	Oakum	3	98	16		864	126
212	Oil, cottonseed and cake	287	5,731	4	1	80,701	12,157
213	Oil, essential	27	92			1,649	156
214	Oil, linseed	17	866			14,405	1,201
215	Oil, not elsewhere specified	115	609	18	1	9,137	776
216	Oilcloth and linoleum, floor	11	1,846	47	85	22,030	2,167
217	Oilcloth, enameled	6	307	4	2	3,597	346
218	Oleomargarine	7	154	8	1	2,698	216
219	Optical goods	89	2,260	736	183	30,422	3,356
220	Ordnance and ordnance stores	3	286			3,910	312
221	Paints	304	5,055	515	11	66,626	6,509
222	Paper and wood pulp	381	28,995	5,982	140	375,759	38,294
223	Paper goods, not elsewhere specified	130	3,033	3,408	129	58,948	7,373
224	Paper patterns	9	146	561	4	7,345	927
225	Patent medicines and compounds	1,154	2,915	2,925	193	60,373	7,704
226	Paving materials	24	782			12,364	1,248
227	Peanuts, grading, roasting, cleaning, and shelling	9	52	276		1,363	459
228	Pencils, lead	3	477	664	32	8,755	1,211
229	Pens, fountain and stylographic	13	225	37	1	2,530	315
230	Pens, gold	6	64	2		1,193	75
231	Perfumery and cosmetics	174	356	650	23	9,019	1,301
232	Petroleum, refining	58	13,036	27	303	184,430	15,278
233	Phonographs and graphophones	8	1,491	199	5	21,241	2,015
234	Photographic apparatus	29	1,307	223	28	16,770	1,771
235	Photographic materials	53	880	633	33	15,497	1,798
236	Photolithographing and photoengraving	117	1,833	197	47	36,569	2,384
237	Pickles, preserves, and sauces	303	2,576	2,514	47	52,742	8,251
238	Pipes, tobacco	32	984	115	19	11,177	1,243
239	Plated ware	33	1,856	221	38	29,481	2,301
240	Plumbers' supplies	107	6,352	165	28	86,034	7,536
241	Pocketbooks	23	270	210	8	4,242	565
242	Pottery, terra cotta, and fire clay products	420	18,324	1,655	383	250,177	24,242
243	Printing and publishing, book and job	4,802	33,594	9,362	1,344	593,204	52,916
244	Printing and publishing, music	33	244	60	1	4,023	346
245	Printing and publishing, newspapers and periodicals	10,860	43,927	10,954	1,544	735,079	64,551
246	Printing materials	57	227	8	5	3,289	277
247	Pulp goods	10	426	38	10	4,722	524
248	Pumps, not including steam pumps	67	955	3	7	11,376	1,113
249	Refrigerators	59	975	2	4	14,296	1,227
250	Regalia and society banners and emblems	79	400	795	15	11,979	1,427
251	Rice, cleaning and polishing	8	118			1,738	241

EARNERS—MEN, WOMEN, AND CHILDREN—IN EACH GROUP OF EARNINGS, WITH EARNINGS AND NUMBER OF EMPLOYED DURING THE YEAR, AND NUMBER OF ESTABLISHMENTS: 1905—Continued.

MEN 16 YEARS AND OVER (DISTRIBUTION OF NUMBER BY EARNINGS).

Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	
$28,693	2,877	130	64	61	65	139	277	424	547	520	327	203	67	44	167
1,473,717	117,374	1,276	1,383	1,708	2,502	4,430	9,277	14,628	15,631	21,015	18,672	14,874	5,405	6,573	168
10,165	1,034	5	30	37	38	65	111	118	121	208	211	75	11	4	169
3,530	319	1	15	17	20	26	18	19	39	62	45	32	16	9	170
152,944	11,024	136	275	419	438	501	568	607	591	1,264	2,021	2,272	1,079	853	171
3,762	352	4	15	15	28	18	24	22	35	32	82	64	9	4	172
14,319	1,773	2	79	112	288	235	328	143	128	212	133	96	14	3	173
11,787	1,292	27	16	12	15	233	131	115	336	197	126	74	7	3	174
6,448	600	21	43	29	52	36	51	33	37	82	89	76	38	13	175
26,818	2,340	27	37	65	78	79	178	202	237	437	438	453	82	27	176
4,055	187	1	2	4	5	5	5	1	6	6	17	30	29	76	177
3,415	323	3	1	19	6	9	49	7	85	80	34	29	1		178
14,562	970	7	5	17	34	45	42	26	74	92	209	234	122	63	179
7,025	555		3	6	3	13	9	17	56	136	156	128	22	6	180
19,093	1,752	18	66	106	107	156	125	120	170	241	278	262	60	43	181
379,076	38,293	519	465	1,024	1,350	2,623	3,826	4,524	6,840	8,317	5,510	2,644	468	183	182
42,338	4,737	142	60	91	99	488	663	326	1,475	865	371	136	18	4	183
6,167	633	3	11	20	40	55	90	59	119	105	84	34	9	4	184
52,125	5,175	130	132	256	177	561	400	185	838	871	929	517	110	69	185
398,621	27,741	249	218	346	435	527	873	480	1,180	2,553	6,584	11,634	2,159	503	186
19,941	1,934	19	26	15	20	44	123	105	373	755	355	88	7	4	187
88,016	5,847	114	247	379	276	251	244	252	300	495	668	889	919	813	188
389,811	31,286	569	491	611	716	985	1,947	2,924	3,651	4,824	6,394	5,139	1,543	1,492	189
43,717	4,196	60	118	253	231	274	391	262	495	625	776	537	131	43	190
1,625,738	175,718	8,020	5,161	8,422	7,777	19,203	19,932	12,772	33,296	22,456	21,313	12,335	3,296	1,735	191
558,392	50,067	915	1,024	1,842	1,988	3,539	3,565	2,922	6,877	6,055	9,273	9,451	2,302	314	192
20,077	1,428	6	2	6	2	7	4	7	82	114	564	574	51	9	193
1,327	96					3	4		17	7	26	26	13		194
372,460	28,197	678	335	479	659	1,090	1,479	1,985	3,427	3,861	3,819	5,886	3,183	1,316	195
6,431	755	3	13	31	43	73	195	110	114	81	60	24	5	3	196
2,075	382	14	4	58	41	32	19	11	34	46	17	5		1	197
39,489	3,894	81	116	160	195	302	293	352	565	629	633	420	123	25	198
25,044	2,011	35	33	58	71	104	120	140	170	338	361	296	178	107	199
89,323	9,059	121	309	419	466	824	633	560	1,157	1,616	1,760	990	148	56	200
13,611	1,158	2	27	34	50	56	73	47	121	146	268	303	23	8	201
29,114	2,017	24	70	74	72	77	85	40	97	146	232	685	392	23	202
108,254	7,867	63	104	119	218	295	296	172	571	723	1,334	3,297	517	158	203
3,311	310	2	3	28	5	11	27	11	46	54	78	37	5	3	204
19,569	1,591	8	16	39	49	62	87	65	154	250	406	354	69	32	205
25,958	2,171	42	66	70	96	140	112	118	208	313	418	410	141	37	206
140,256	10,931	90	165	289	404	430	502	646	912	1,473	2,491	2,529	622	378	207
56,082	4,577	28	54	146	200	258	277	340	443	707	930	736	317	141	208
3,170	288	8	5	14	15	12	22	20	34	59	39	51	8	1	209
753	57			2			1	1	3	15	15	15	3	2	210
814	108	7	8	2	3	20	32	6	17	7	1	4	1		211
80,669	12,144	1,251	889	1,438	1,116	2,062	2,077	580	1,330	646	526	189	33	7	212
1,649	156			3		12	11	15	39	37	23	12	3	1	213
14,405	1,201	22	7	4	3	6	52	20	98	467	401	103	13	5	214
8,926	751	7	4	10	14	25	31	20	105	162	230	121	16	6	215
21,383	2,031	2	7	8	34	46	219	299	524	308	286	254	37	7	216
3,556	339			11	19	15	36	40	59	57	71	28	3		217
2,647	208			3	4	4	2	5	22	44	56	51	9	8	218
25,198	2,382	24	40	94	79	222	239	205	267	336	481	297	74	24	219
3,910	312	5	6	10	6	11	2	19	26	35	106	73	11	2	220
63,185	5,900	199	117	129	164	225	347	502	895	1,371	1,095	643	155	58	221
337,546	31,735	666	376	499	579	1,173	2,232	3,018	7,811	6,328	4,914	3,103	796	240	222
37,069	3,303	56	74	123	138	190	248	215	449	552	584	494	132	48	223
2,317	153		2	5	9	11	8	7	12	18	14	18	18	31	224
38,438	3,655	56	91	163	210	288	304	243	468	609	547	472	112	92	225
12,364	1,248	99	43	42	38	63	68	138	175	254	163	106	41	18	226
477	67			1	8	38	5	2	6	3	2	1	1		227
5,146	485	10	42	32	25	27	33	15	24	68	99	82	21	7	228
2,286	267	3	35	39	18	26	21	8	22	22	35	27	8	3	229
1,172	73		4	3	4	3	1	2		4	12	9	23	8	230
4,372	411	2	19	31	33	30	35	36	25	56	62	50	16	16	231
182,632	14,838	297	186	276	260	496	480	529	2,985	2,312	2,784	3,238	799	196	232
19,926	1,796	97	48	52	59	67	106	133	184	292	373	325	49	11	233
14,933	1,464	16	37	49	60	86	104	117	139	279	441	111	20	5	234
11,099	951	8	16	37	45	38	46	57	86	193	231	135	42	17	235
34,773	2,085	43	86	90	96	87	70	49	60	144	214	369	343	434	236
34,774	4,040	535	145	123	131	268	349	424	633	586	516	252	62	16	237
10,394	1,095	18	92	87	85	107	96	89	70	148	143	127	23	10	238
27,752	1,998	23	37	47	58	86	68	111	96	241	374	652	174	31	239
84,884	7,328	57	112	273	180	246	393	330	1,223	1,242	1,413	1,377	381	101	240
2,844	321	4	28	34	35	36	38	23	21	38	17	26	14	7	241
237,287	21,838	426	262	473	713	997	1,849	2,291	4,682	3,751	2,963	2,126	765	540	242
509,174	39,345	915	1,461	1,764	1,660	1,961	1,948	1,921	2,417	3,745	6,033	9,865	3,824	1,831	243
3,554	274		12	8	11	9	15	9	12	38	71	70	12	7	244
652,017	49,642	1,664	1,749	1,876	2,156	3,048	2,410	2,380	3,393	5,940	7,447	8,175	4,568	4,836	245
3,209	263	3	4	7	17	10	13	14	25	39	53	45	22	11	246
4,421	453		16	17	12	29	61	33	89	43	110	36	6	1	247
11,329	1,101	30	20	26	44	89	144	114	153	165	145	121	39	11	248
14,262	1,220	9	54	37	44	43	61	91	113	186	308	209	52	13	249
5,542	459	4	12	23	26	24	36	30	39	61	95	67	18	24	250
1,738	241	43	27	14	6	31	19	4	43	24	19	4	6	1	251

TABLE 67.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY SPECIFIED INDUSTRIES—NUMBER OF WAGE-ALL WAGE-EARNERS AND OF EACH CLASS, AVERAGE NUMBER OF MEN, WOMEN, AND CHILDREN

	INDUSTRY.	Number of establishments.	AVERAGE NUMBER OF WAGE-EARNERS.			TOTAL.	
			Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Earnings.	Number.
252	Roofing materials	141	2,355	8	34	$33,565	2,989
253	Rubber and elastic goods	133	9,475	4,703	296	158,858	16,211
254	Rules, ivory and wood	7	67	50	2	824	121
255	Saddlery and harness	760	6,303	525	182	85,260	8,153
256	Safes and vaults	18	2,018		10	26,688	2,178
257	Salt	57	1,444	103		18,652	2,064
258	Sausage	198	701	11	4	9,391	827
259	Saws	48	1,258	14	64	17,194	1,435
260	Scales and balances	52	2,077	12	13	27,566	2,315
261	Screws, machine	20	1,572	72	76	17,967	1,856
262	Screws, wood	5	763	473	37	12,748	1,594
263	Sewing machine cases	3	2,089	20	217	23,659	2,451
264	Sewing machines and attachments	27	5,353	103	16	74,049	5,941
265	Shipbuilding, iron and steel	28	17,071	23	300	252,392	22,552
266	Shipbuilding, wooden, including boat building	518	5,235	9	7	109,887	8,835
267	Shirts	242	2,598	10,960	648	106,088	16,765
268	Shoddy	59	870	260	3	11,423	1,428
269	Show cases	83	1,633	12	10	20,945	1,892
270	Silk and silk goods	205	8,985	15,866	2,539	221,980	30,486
271	Silversmithing and silverware	53	4,745	589	99	78,523	6,448
272	Slaughtering and meat packing, wholesale	348	25,961	1,193	466	351,443	32,986
273	Slaughtering, wholesale, not including meat packing	269	2,557	3	4	39,880	2,832
274	Smelting and refining, copper	18	6,044		41	108,290	6,965
275	Smelting and refining, lead	12	2,927	7		44,210	3,583
276	Smelting and refining, zinc	14	2,437	2	15	31,702	2,843
277	Smelting and refining, not from the ore	39	878	4		14,356	1,172
278	Soap	275	3,722	1,612	123	53,273	6,325
279	Soda water apparatus	18	629	38	3	11,090	929
280	Sporting goods	88	976	673	18	17,478	2,130
281	Springs, steel, car and carriage	27	1,245		10	16,827	1,561
282	Stamped ware	86	5,840	1,510	136	73,022	8,239
283	Starch	73	645	77	5	13,583	1,263
284	Stationery goods, not elsewhere specified	82	1,314	1,150	61	21,684	2,923
285	Statuary and art goods	82	639	29	6	16,128	1,014
286	Steam fittings and heating apparatus	124	8,681	48	9	123,270	10,163
287	Steam packing	61	1,211	100		15,923	1,607
288	Stencils and brands	74	347	14	23	4,713	423
289	Stereotyping and electrotyping	85	1,406	28	21	22,708	1,560
290	Stoves and furnaces, not including gas and oil stoves	206	14,963	13	186	230,667	17,910
291	Stoves, gas and oil	46	1,864	10	3	27,905	2,595
292	Straw goods, not elsewhere specified	4	20	23		768	90
293	Structural ironwork	418	15,985	4	17	248,807	21,598
294	Sugar and molasses, refining	60	6,351	199	45	91,192	7,920
295	Sulphuric, nitric, and mixed acids	17	1,305			20,384	1,750
296	Surgical appliances	94	376	276	8	7,164	750
297	Tin and terne plate	17	2,607	421	2	41,814	3,900
298	Tinfoil	6	339	283		5,199	637
299	Tinware	234	8,050	2,318	186	118,499	14,646
300	Tobacco, chewing and smoking, and snuff	229	7,461	5,069	1,196	91,992	16,165
301	Tobacco, cigars and cigarettes	9,033	38,702	29,387	2,779	734,971	84,292
302	Tools, not elsewhere specified	398	7,159	321	80	93,355	8,702
303	Toys and games	79	1,089	268	122	15,3[illegible]7	2,034
304	Trunks and valises	230	3,463	377	90	43,279	4,513
305	Turpentine and rosin	383	5,262	1	15	40,275	7,714
306	Type founding	16	875	237	53	17,428	1,384
307	Typewriters and supplies	45	3,646	334	20	55,116	4,647
308	Umbrellas and canes	106	476	715	40	11,319	1,484
309	Upholstering materials	120	1,056	497	46	17,220	2,002
310	Varnishes	129	910	45	4	13,034	1,046
311	Vault lights and ventilators	15	99			1,582	123
312	Vinegar and cider	424	813	41	1	20,437	2,140
313	Wall paper	21	1,479	184	137	23,161	2,319
314	Washing machines and clothes wringers	54	763	4	24	8,540	943
315	Watch and clock materials	11	149	117	2	2,949	314
316	Watch cases	12	1,333	503	29	22,836	2,126
317	Watches	7	2,599	2,401		66,368	5,214
318	Wheelbarrows	13	145		1	1,577	192
319	Whips	36	517	243	51	7,806	922
320	Windmills	40	1,502			18,882	1,745
321	Window shades and fixtures	105	895	381	30	12,694	1,528
322	Wire	14	2,391	80	18	33,341	3,031
323	Wirework, including wire rope and cable	374	6,264	1,194	268	93,704	9,446
324	Wood carpet	11	213	1	1	5,413	329
325	Wood distillation, not including turpentine and rosin	69	1,023			12,665	1,234
326	Wood preserving	13	412		6	5,190	658
327	Wood, turned and carved	584	6,137	141	128	71,635	8,264
328	Woodenware, not elsewhere specified	114	2,631	385	165	33,678	3,794
329	Wool pulling	21	420		1	6,243	591
330	Wool scouring	11	441	11	6	6,919	592
331	Woolen goods	366	24,741	13,024	1,941	361,159	43,881
332	Worsted goods	108	18,816	18,013	3,979	362,122	45,803
333	All other industries	[1] 11	147	81	3	2,254	264

[1] Embraces cardboard not made in paper mills, 2; millstones, 2; oil, castor, 2; oil, lard, 2; pens, steel, 1; pulp, from fiber other than wood, 1; sand and emery paper and cloth, 1.

EARNERS—MEN, WOMEN, AND CHILDREN—IN EACH GROUP OF EARNINGS, WITH EARNINGS AND NUMBER OF EMPLOYED DURING THE YEAR, AND NUMBER OF ESTABLISHMENTS: 1905—Continued.

MEN 16 YEARS AND OVER (DISTRIBUTION OF NUMBER BY EARNINGS).															
Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	
$33,339	2,933	29	22	39	47	116	247	241	472	485	720	397	69	49	252
122,498	10,885	91	96	256	383	489	687	944	1,848	2,138	2,030	1,600	248	75	253
635	65	1	1	4	3	1	10	2	12	8	19	4			254
81,489	7,323	102	218	198	288	382	457	433	688	1,176	1,778	1,412	165	26	255
26,628	2,165	28	42	47	50	67	78	148	423	281	482	358	116	45	256
18,124	1,951	105	56	62	54	89	166	131	519	437	261	64	7		257
9,299	810	11	8	22	25	19	32	26	70	192	234	154	15	2	258
16,814	1,365	48	46	44	47	87	85	118	126	162	188	258	111	45	259
27,340	2,284	14	12	37	58	101	117	247	329	327	466	397	116	63	260
17,236	1,697	11	27	131	99	124	136	162	160	248	389	178	20	12	261
9,269	918	8	31	32	20	24	139	144	96	186	141	87	10		262
22,526	2,207		35	38	50	97	272	370	305	459	396	164	21		263
73,189	5,813	19	33	63	135	218	254	387	723	1,092	1,453	1,088	241	107	264
251,015	22,173	456	464	796	1,034	1,088	1,537	1,499	2,068	3,653	3,899	4,409	934	336	265
109,792	8,817	341	210	187	264	275	400	259	813	1,069	1,854	2,535	479	131	266
29,344	2,876	41	140	172	213	282	299	249	230	391	378	345	90	46	267
9,952	1,123	11	12	27	57	101	222	155	257	136	94	37	9	5	268
20,822	1,869	14	36	63	64	70	79	107	209	350	528	311	34	4	269
104,502	9,888	220	397	566	546	559	554	651	1,143	1,393	1,933	1,523	303	100	270
73,635	5,607	26	156	227	162	212	227	201	517	725	1,113	1,423	393	225	271
338,560	30,824	581	379	497	704	1,159	1,577	2,317	4,311	8,249	6,636	3,676	533	205	272
39,759	2,815	25	15	18	32	46	71	61	162	501	818	714	219	133	273
107,978	6,921	78	59	36	83	135	186	322	467	849	1,111	1,617	1,578	400	274
44,107	3,573	53	25	35	34	192	378	208	137	924	709	778	80	20	275
31,620	2,826	125	78	86	71	114	158	191	287	606	575	432	70	33	276
14,330	1,166	9	11	10	11	18	16	31	49	284	538	180	9		277
43,580	4,310	121	95	165	220	278	238	237	662	1,007	768	406	82	31	278
10,545	812	12	7	23	24	24	19	33	58	122	212	215	48	15	279
12,303	1,214	10	37	49	71	89	104	116	175	195	212	119	26	11	280
16,783	1,548	73	32	39	67	90	170	130	180	248	225	177	86	31	281
62,833	6,381	161	303	332	397	441	610	747	839	1,041	703	608	150	49	282
12,881	1,135	19	19	29	18	63	40	38	158	269	289	145	37	11	283
14,556	1,513	47	74	102	89	131	107	136	179	184	259	161	32	12	284
15,858	964	3	5	29	20	30	16	37	62	111	127	233	175	116	285
122,865	10,553	91	153	212	203	409	509	953	1,907	1,835	1,816	1,988	385	92	286
15,247	1,480	41	21	22	61	111	129	192	309	229	177	136	45	7	287
4,480	379	4	14	10	19	21	11	25	38	58	56	94	28	1	288
22,383	1,507	17	58	54	106	87	62	53	93	108	149	261	256	203	289
229,500	17,629	291	301	407	527	606	1,011	1,323	2,039	2,162	2,534	3,760	1,710	958	290
27,798	2,574	22	32	121	89	123	234	260	384	390	482	349	76	12	291
382	35						2	2	18	2	6	2	3		292
248,664	21,572	209	197	328	481	829	1,257	2,257	3,731	3,765	3,700	3,601	1,014	203	293
89,502	7,578	102	57	88	110	125	264	290	1,639	1,996	1,596	964	275	72	294
20,369	1,747	54	34	20	36	55	47	102	288	273	473	245	83	37	295
5,206	429	3	9	22	20	24	31	22	34	50	69	88	44	13	296
38,042	3,331	18	8	15	29	24	190	665	509	585	347	817	118	6	297
3,797	351		18	15	26	29	23	17	25	51	62	77	5	3	298
102,221	11,376	1,300	710	706	654	838	895	917	1,124	1,487	1,374	925	311	135	299
59,687	8,703	664	978	1,168	1,160	1,140	877	626	632	632	481	270	56	19	300
520,028	46,680	1,244	1,735	1,925	2,353	2,671	2,493	2,951	3,470	7,493	10,248	7,799	1,654	644	301
90,894	8,203	109	179	208	334	501	586	661	1,099	1,344	1,662	1,222	208	90	302
12,061	1,411	35	78	95	111	163	138	136	189	167	167	98	26	8	303
40,567	3,976	120	122	204	243	320	291	326	418	557	708	523	110	34	304
40,234	7,697	372	800	1,579	2,895	1,077	369	292	85	117	104	7			305
15,429	1,012	17	25	37	38	30	39	35	55	81	158	262	133	102	306
52,034	4,226	28	37	93	143	151	223	341	446	741	1,065	757	150	51	307
5,999	590	7	29	32	40	60	47	54	40	75	99	79	17	11	308
13,609	1,385	13	17	37	48	135	127	110	382	178	179	100	31	28	309
12,747	997	2	19	23	20	42	42	51	93	189	266	150	43	57	310
1,582	123			7	2	4	8	4	7	19	25	30	11	6	311
20,029	2,042	26	27	22	44	120	165	173	659	296	357	138	12	3	312
21,212	1,880	4	28	140	118	183	174	172	297	213	116	125	177	133	313
8,402	911	14	21	32	48	86	130	91	178	154	81	62	7	7	314
2,038	176		5	2	8	10	9	15	19	26	40	31	7	4	315
19,457	1,543	28	82	68	75	72	93	59	82	166	282	380	124	33	316
44,269	2,740	6	35	72	34	64	62	51	123	201	384	1,057	479	172	317
1,575	191	14	8	8	5	30	22	24	27	33	6	9	4	1	318
5,908	582	1	1	37	24	49	36	58	105	110	101	51	8	1	319
18,882	1,745	23	35	40	27	50	72	144	464	314	280	269	22	5	320
9,925	1,009	26	67	79	51	69	60	60	128	126	178	134	28	3	321
32,703	2,913	22	44	37	57	81	145	566	470	615	507	277	81	11	322
83,216	7,610	95	175	300	304	527	569	601	1,074	1,231	1,443	1,002	190	99	323
5,399	325		1	4	4	7	9	10	22	22	31	89	126		324
12,665	1,234	1	1	15	13	50	53	114	348	388	187	55	9		325
5,172	650	82	36	22	51	66	88	44	112	44	74	23	6	2	326
70,073	7,880	190	246	539	653	838	1,015	697	1,242	828	860	602	156	14	327
30,626	3,125	95	40	77	88	181	192	303	879	575	429	223	34	9	328
6,236	590	11		6	14	38	30	66	68	175	108	66	6	2	329
6,624	556	4	1	1	2	7	11	38	143	79	148	100	16	6	330
252,597	27,202	443	386	790	1,196	2,918	4,459	3,432	4,104	4,530	3,201	1,335	267	141	331
208,778	21,243	363	306	977	1,633	2,027	2,639	2,189	1,793	3,109	3,799	2,047	244	117	332
1,870	175	4	7	3	8	4	7	11	31	22	51	22	5		333

TABLE 67.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY SPECIFIED INDUSTRIES—NUMBER OF WAGE-ALL WAGE-EARNERS AND OF EACH CLASS, AVERAGE NUMBER OF MEN, WOMEN, AND CHILDREN

	INDUSTRY.	WOMEN 16 YEARS AND OVER (DISTRIBUTION OF NUMBER BY EARNINGS).					
		Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.
1	All industries	$3,633,481	588,599	43,858	64,170	88,657	95,674
2	Agricultural implements	845	147	17	14	31	12
3	Ammunition	3,715	614	18	20	72	131
4	Artificial feathers and flowers	11,445	1,845	245	221	264	290
5	Artificial limbs	74	11				2
6	Artificial stone	6	1				
7	Artists' materials	144	29	1		18	3
8	Automobile bodies and parts	57	8				3
9	Automobiles	27	4				2
10	Awnings, tents, and sails	7,344	1,112	30	37	124	183
11	Axle grease	59	15		8	4	
12	Babbitt metal and solder	41	6			1	
13	Bags, other than paper	8,014	1,723	223	350	402	346
14	Bags, paper	2,161	442	42	49	71	192
15	Baking and yeast powders	3,918	642	28	64	120	103
16	Baskets, and rattan and willow ware	2,554	523	86	104	104	79
17	Beet sugar	43	4				
18	Bells	210	34	1		3	13
19	Belting and hose, leather	146	23			4	5
20	Belting and hose, linen	854	169	13	35	39	36
21	Belting and hose, rubber	1,944	312	1	88	52	52
22	Bicycles and tricycles	85	10		4		
23	Billiard tables and materials	74	16	1	6	3	3
24	Blacking	2,143	381	30	24	92	73
25	Bluing	191	39	2	8	18	3
26	Bone, ivory, and lamp black	18	4	1		1	1
27	Bookbinding and blank book making	28,906	4,717	154	589	742	811
28	Boot and shoe cut stock	8,154	1,616	172	243	296	369
29	Boot and shoe findings	7,714	1,371	120	143	235	263
30	Boot and shoe uppers	473	59	2	3		6
31	Boots and shoes	229,468	30,195	1,370	2,052	2,814	3,510
32	Boots and shoes, rubber	56,440	6,773	119	132	461	563
33	Boxes, cigar	8,237	1,404	102	244	236	235
34	Boxes, fancy and paper	59,955	10,936	1,049	1,827	1,947	1,851
35	Boxes, wooden packing	4,545	819	67	141	118	128
36	Brass						
37	Brass and copper, rolled	2,191	348	20	23	31	55
38	Brass castings and brass finishing	568	105	4	17	26	25
39	Brassware	10,313	1,578	75	120	193	243
40	Bread and other bakery products	52,494	9,618	720	1,503	1,669	1,723
41	Brick and tile	61	11	2		3	2
42	Bronze castings	66	15		6	5	3
43	Brooms and brushes	8,705	2,036	419	430	513	248
44	Butter	787	136	15	9	18	26
45	Butter, reworking	47	8				1
46	Buttons	12,850	2,603	508	319	509	374
47	Calcium lights	20	3		1		1
48	Candles	440	101	1	35	31	22
49	Canning and preserving, fish	18,992	2,237	100	124	142	170
50	Canning and preserving, fruits and vegetables	117,035	21,661	3,314	2,892	4,787	2,516
51	Canning and preserving, oysters	291	72	1	28	34	4
52	Card cutting and designing	849	151	4	19	29	46
53	Carpets and rugs, other than rag	32,293	4,416	121	113	438	810
54	Carpets, rag	1,253	248	23	45	57	41
55	Carriage and wagon materials	901	177	14	19	51	40
56	Carriages and sleds, children's	639	102	3	7	13	18
57	Carriages and wagons	3,702	633	33	85	95	115
58	Cars and general shop construction and repairs by steam railroad companies	3,027	414	2	43	6	6
59	Cars and general shop construction and repairs by street railroad companies	125	17	1			1
60	Cars, steam railroad, not including operations of railroad companies	1,006	139	1	14	6	22
61	Cars, street railroad, not including operations of railroad companies	52	7				
62	Cash registers and calculating machines	2,879	424	2	9	63	90
63	Cement	48	11	2	4	2	2
64	Charcoal						
65	Cheese	320	62	7	10	18	6
66	Chemicals	3,551	685	72	139	116	121
67	China decorating	307	56	6	14	10	11
68	Chocolate and cocoa products	2,594	508	14	32	52	173
69	Cleansing and polishing preparations	716	153	17	48	26	23
70	Clocks	9,655	1,284	6	21	65	161
71	Cloth, sponging and refinishing						
72	Clothing, horse	1,150	171			35	23
73	Clothing, men's	166,801	27,485	2,272	2,838	3,680	4,813
74	Clothing, men's, buttonholes	1,097	189	4	13	25	54
75	Clothing, women's	183,259	26,735	1,622	2,244	3,113	3,621
76	Coffee and spice, roasting and grinding	7,426	1,355	34	151	323	339
77	Coffins, burial cases, and undertakers' goods	4,990	792	42	68	135	88
78	Coke						
79	Collars and cuffs	41,003	5,349	314	514	464	476
80	Combs	630	99	1	2	8	29
81	Condensed milk	5,716	843	20	45	80	128

EARNERS—MEN, WOMEN, AND CHILDREN—IN EACH GROUP OF EARNINGS, WITH EARNINGS AND NUMBER OF EMPLOYED DURING THE YEAR, AND NUMBER OF ESTABLISHMENTS: 1905—Continued.

WOMEN 16 YEARS AND OVER (DISTRIBUTION OF NUMBER BY EARNINGS)—continued.							CHILDREN UNDER 16 YEARS (DISTRIBUTION OF NUMBER BY EARNINGS).									
$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
97,311	68,192	47,170	34,050	29,633	14,294	5,590	$312,023	90,167	31,860	28,636	17,905	7,060	3,280	839	587	1
36	13	12	10	1	1		592	190	88	48	36	8	6	3	1	2
235	92	24	15	3		4	99	19		1	4	13		1		3
185	157	145	101	112	87	38	112	34	8	20	5	1				4
4	4	1					30	7	2	1		2	2			5
1							17	4		2	1		1			6
	5	1		1			13	5	5							7
	3		2				11	3	1	1		1				8
1			1				224	40	2	3	8	7	10	9	1	9
268	170	129	82	57	30	2	101	23	1	9	7		4	2		10
2	1						4	1			1					11
2	2			1												12
203	143	33	15	7	1		312	92	30	37	17	5	3			13
61	16	4	1	3	3		7	3	3							14
105	70	65	43	29	15		60	20	8	10		1	1			15
66	27	12	25	18	2		400	120	50	35	25	3	5		2	16
	2				2		424	46					12		34	17
9	5	1	1		1		41	9	2	1	2		1	3		18
7	1	2	4				5	2	1	1						19
19	10	9	2	3	8		52	14	2	8	1	3				20
41	24	21	23	8	2		240	62	4	32	20	6				21
		4			1	1	47	13	5	4	4					22
1				2			18	5		4		1				23
61	49	18	10	21	3		101	30	8	14	13					24
3	3		1	1			27	7		2	5					25
1																26
884	594	301	241	173	94	44	1,348	367	72	158	76	49	5	3	4	27
287	116	58	35	32	7	1	743	207	56	82	39	21	8		1	28
280	147	73	40	43	26	1	359	102	30	31	27	9	5			29
3	17	6	6	7	7	2	8	2		1	1					30
3,691	3,745	3,164	2,995	3,572	2,394	888	9,493	2,665	861	823	645	206	105	15	10	31
747	986	979	1,475	1,026	269	16	1,714	395	90	97	95	66	25	19	3	32
200	150	105	68	57	7		294	98	53	28	14	2	1			33
1,590	1,067	660	447	352	116	30	3,634	1,240	584	500	101	41	10	4		34
110	110	42	46	30	21	6	2,784	815	257	298	179	49	21	6	5	35
																36
106	54	36	16	5	2		183	35	1	2	19	4	5	3	1	37
18	5	4	4	1		1	287	62	12	17	30	1	1	1		38
337	268	181	98	54	7	2	671	176	26	71	60	17	2			39
1,709	971	518	355	327	103	20	4,644	1,231	357	377	208	135	78	33	43	40
1	1	1		1			3,033	811	229	230	176	74	79	14	9	41
1							37	9	3	3		2			1	42
210	114	42	27	27	4	2	1,009	304	97	109	61	27	9	1		43
30	11	11	7	4	3	2	77	23	12	4	2	3	1	1		44
7							4	1			1					45
346	261	151	68	48	12	7	634	169	46	54	46	21		2		46
					1											47
11	1						107	30	7	8	15					48
263	258	266	301	276	215	122	2,802	576	107	103	106	93	85	46	36	49
2,682	2,113	903	809	842	502	301	8,687	2,685	1,357	517	380	176	159	49	47	50
3	2						28	9		9						51
23	7	13	3	5		1	33	9		6	3					52
602	609	571	526	515	106	5	2,434	571	83	167	221	78	12	8	2	53
39	16	18	4	5			118	39	14	16	8	1				54
29	11	7	3		1	2	777	174	31	28	56	22	29	4	4	55
29	12	7	8	5			115	32	15	4	5	6	2			56
110	94	54	28	12	4	3	1,285	364	124	96	87	47	8	1	1	57
126	99	55	50	27			482	97		33	6	44	8	5	1	58
	6	9					16	4		2	1		1			59
8	43	21	13	8	3		220	50	8	9	30	8				60
2	4	1					157	40		20	16	4				61
79	70	54	32	15	9	1	20	5		4	2					62
			1				308	62	2	12	19	25	4			63
							27	10	7	3						64
9	4	3		4	2		64	19	7	6	3	2	1			65
76	64	40	25	22	9	1	147	31	2	3	14	6	3	2	1	66
3	6	3		1		2	9	2			1	1				67
206	11	10	9	1			59	10			1	6	1	2		68
19	5	8	5	1	1		17	5	2	2		1				69
181	296	336	156	56	4	8	864	204	15	77	82	23	7			70
																71
33	31	20	11	13	3	2										72
4,870	3,182	2,233	1,617	1,294	516	170	2,277	764	394	238	94	20	13	5		73
43	34	9	4	2	1		37	11	3	4	3	1				74
4,202	3,332	2,797	1,974	2,074	1,155	601	1,299	372	107	136	83	43	3			75
236	146	71	22	24	8	1	195	57	28	9	16	1	3			76
150	108	69	57	44	26	5	181	46	10	13	14	6	2	1		77
							302	72	7	30	23	4	3	3	2	78
577	581	597	476	646	486	218	347	100	7	64	24	4	1			79
28	20	4	5	1	1		154	34	3	2	14	10	3	2		80
217	104	126	56	33	27	1	267	79	34	22	13	3	3	4		81

TABLE 67.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY SPECIFIED INDUSTRIES—NUMBER OF WAGE-
ALL WAGE-EARNERS AND OF EACH CLASS, AVERAGE NUMBER OF MEN, WOMEN, AND CHILDREN

	INDUSTRY.	WOMEN 16 YEARS AND OVER (DISTRIBUTION OF NUMBER BY EARNINGS).					
		Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.
82	Confectionery	$57,088	11,831	1,220	3,042	2,467	2,131
83	Cooperage	80	21	[illegible]	3	1	3
84	Coppersmithing and sheet iron working	584	101	4	21	20	18
85	Cordage and twine	16,844	3,075	64	442	812	722
86	Cordials and sirups	1,409	353	75	122	75	45
87	Cork, cutting	1,547	324	1	58	127	73
88	Corsets	28,905	4,718	435	443	475	[illegible]
89	Cotton goods	494,118	81,937	5,109	8,597	11,948	13,705
90	Cotton small wares	9,940	1,574	40	107	187	278
91	Cotton waste	737	159	2	12	70	35
92	Crucibles						
93	Cutlery and edge tools	4,307	683	31	81	96	159
94	Dairymen's, poulterers', and apiarists' supplies	977	205	10	56	65	25
95	Dentists' materials	1,365	214	17	5	23	29
96	Drug grinding	543	131	62	20	12	15
97	Druggists' preparations	10,350	1,922	46	280	514	429
98	Dyeing and finishing textiles	20,506	3,424	136	216	598	689
99	Dyestuffs and extracts	21	4	1			
100	Electrical machinery, apparatus, and supplies	45,223	7,104	327	510	934	1,273
101	Electroplating	342	51	2	5	3	[illegible]
102	Emery wheels	58	9			2	1
103	Enameling and enameled goods	2,967	508	16	93	95	75
104	Engravers' materials						
105	Engraving and diesinking	259	43	1	5	7	4
106	Engraving, steel, including plate printing	2,548	424	21	78	58	55
107	Engraving, wood	3	1		1		
108	Envelopes	14,026	2,177	56	206	246	332
109	Explosives	175	32		5	9	6
110	Fancy articles, not elsewhere specified	9,248	1,682	223	301	324	240
111	Felt goods	2,003	321	9	20	30	54
112	Fertilizers	524	88	13	21	1	9
113	Files	1,273	192	3	9	30	19
114	Firearms	192	26		4	2	
115	Fire extinguishers, chemical	[illegible]	1				
116	Fireworks	1,365	261	17	50	56	51
117	Flags and banners	660	134	19	34	13	29
118	Flavoring extracts	2,939	604	42	86	112	160
119	Flax and hemp, dressed						
120	Flour and grist mill products	1,111	174	11	16	20	44
121	Food preparations	13,520	2,522	197	394	563	469
122	Foundry and machine shop products	11,813	2,025	70	208	351	512
123	Foundry supplies	38	8		2	[illegible]	1
124	Fur goods	18,274	2,124	35	75	122	182
125	Furnishing goods, men's	48,362	7,979	731	918	1,150	1,504
126	Furniture	10,577	1,911	262	271	252	354
127	Furs, dressed	116	15	1			1
128	Galvanizing						
129	Gas and lamp fixtures	5,765	971	38	83	185	163
130	Gas, illuminating and heating	185	25			5	1
131	Gas machines and meters	494	85	10	10	17	14
132	Glass	8,738	1,721	171	373	431	253
133	Glass, cutting, staining, and ornamenting	2,186	404	17	84	102	78
134	Gloves and mittens, leather	17,998	2,857	365	241	395	297
135	Glucose	748	116	2		18	32
136	Glue	1,060	203	41	10	31	31
137	Gold and silver, leaf and foil	1,135	185	2	10	29	57
138	Gold and silver, reducing and refining, not from the ore	7	1				
139	Graphite and graphite refining	16	4		2	1	1
140	Grease and tallow	27	5			2	
141	Grindstones						
142	Gypsum wall plaster	227	34	2	1	1	
143	Hairwork	1,747	265	10	22	21	42
144	Hammocks	25	6	2		1	[illegible]
145	Hand knit goods	953	169	4	22	20	20
146	Hand stamps	677	94	2	1	11	16
147	Hardware	9,627	1,801	85	366	409	318
148	Hardware, saddlery	485	86		15	27	11
149	Hat and cap materials	1,139	227	19	72	27	32
150	Hats and caps, other than felt, straw, and wool	7,875	1,140	44	104	131	191
151	Hats, felt	23,398	3,203	80	201	321	443
152	Hats, straw	22,010	2,945	167	181	263	395
153	Hats, wool	1,467	270	59	30	44	37
154	Hones and whetstones	8	3	3			
155	Horseshoes						
156	Hosiery and knit goods	177,317	29,502	2,160	3,016	4,421	4,779
157	House furnishing goods, not elsewhere specified	7,955	1,119	31	36	119	151
158	Ice, manufactured	45	11	4	2		2
159	Ink, printing	33	5				2
160	Ink, writing	1,258	231	29	33	53	44
161	Instruments, professional and scientific	995	171	2	29	39	35
162	Iron and steel, blast furnaces	5	1				1
163	Iron and steel, bolts, nuts, washers, and rivets, not made in rolling mills or steel works	3,710	644	6	12	104	166
164	Iron and steel, doors and shutters						
165	Iron and steel forgings						
166	Iron and steel, nails and spikes, cut and wrought, including wire nails, not made in rolling mills or steel works	3,681	612	19	55	75	134

EARNERS—MEN, WOMEN, AND CHILDREN—IN EACH GROUP OF EARNINGS, WITH EARNINGS AND NUMBER OF EMPLOYED DURING THE YEAR, AND NUMBER OF ESTABLISHMENTS: 1905—Continued.

WOMEN 16 YEARS AND OVER (DISTRIBUTION OF NUMBER BY EARNINGS)—continued.							CHILDREN UNDER 16 YEARS (DISTRIBUTION OF NUMBER BY EARNINGS).									
$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
1,390	749	367	199	162	73	31	$3,168	1,029	459	458	70	28	10	1	3	82
3	1			1			825	244	125	37	26	32	16	6	2	83
11	6	3	9	7	2		340	84	9	29	24	13	4	1	4	84
653	260	77	25	14	6		1,771	542	218	200	70	31	17	6		85
24	9	2		1			4	1			1					86
36	18	11					324	128	45	80	3					87
793	579	481	423	318	115	36	353	108	30	56	8	10	4			88
14,861	11,354	8,100	4,912	2,992	343	16	81,155	25,249	11,407	7,597	4,165	1,378	520	110	72	89
396	240	154	102	48	21	1	566	175	35	113	16	6	3	1	1	90
31	4	2	3													91
																92
160	85	35	13	10	7	6	968	251	56	81	50	45	10	2	7	93
22	13	7	2	3	2		71	18	3	5	7	1	2			94
35	85	8	6	5		1	100	27	3	12	9		2	1		95
13	6	3					4	1			1					96
320	161	89	42	22	14	5	170	64	37	21	5	1				97
1,143	287	163	114	61	10	7	3,250	775	62	211	364	116	18	4		98
2	1						14	6	4	2						99
1,336	1,236	860	346	226	53	3	1,948	531	134	174	140	48	20	9	6	100
17	4	5	9	3			139	37	3	15	13	6				101
2	2	2					7	2		2						102
67	79	31	23	22	3	4	153	40	5	23	11			1		103
																104
16	3	1	1	4	1		105	32	12	8	10		2			105
46	78	55	9	14	7	3	210	60	4	38	15	2			1	106
							12	3		1	1	1				107
475	384	238	149	72	17	2	413	124	37	39	37	8	2	1		108
4	4	1	1	2												109
217	133	72	65	54	31	13	442	158	56	77	15	6	3	1		110
102	47	20	21	14	4		23	5		1	3	1				111
13	9	13	1	5	3		110	40	19	17	3	1				112
31	34	29	26	11			364	91	5	35	47	4				113
5	5	2	1	5	2		147	43	6	19	12	6				114
		1														115
47	12	17	6	4		1	50	19	18	1						116
17	9	2	6	2	3		10	2		1			1			117
132	40	17	10	4	1		42	14	4	4	5	1				118
																119
34	5	7	4	25	7	1	240	73	27	24	13	4	4	1		120
478	173	113	60	53	17	5	416	102	24	29	18	14	11	3	3	121
412	236	88	65	51	19	13	5,246	1,307	227	475	388	105	65	18	29	122
3							11	3		2	1					123
281	227	266	232	325	272	107	81	24	8	8	7				1	124
1,298	739	517	360	423	225	114	530	177	56	106	9	2	4			125
261	209	119	66	61	43	13	4,585	1,292	394	425	269	154	43	6	1	126
4	1	3		4	1		30	8		5	2	1				127
							65	11				8	3			128
203	133	104	37	19	3	1	1,021	250	25	69	123	33				129
1	2	12	1	2	1		16	7	5	1	1					130
5	14	9	3	2	1		16	4		2	2					131
202	116	60	49	29	24	13	13,244	3,137	407	954	944	463	284	38	47	132
48	29	20	18	10	4	4	382	107	17	59	17	12	2			133
418	276	292	238	201	106	28	279	86	26	49	7	2	2			134
1	62			1			81	16			9	5	2			135
50	24	15	1				109	30	8	11	10	1				136
30	25	20	2	6	3	1	33	8		3	2	3				137
	1															138
																139
3							10	2				2				140
																141
25	2				3		38	9	1	5			2		1	142
50	45	27	16	22	8	2	10	3		2	1					143
1																144
85	8	5	5				11	4	2	2						145
23	12	14	3	5	4	3	224	57	1	27	23	2		1	3	146
267	173	91	55	26	10	1	1,976	492	60	188	138	68	30	6	2	147
13	6	4	2	7	1		64	17	4	6	5		2			148
52	10	7	1	4	3		123	32	8	13	9	1	1			149
195	165	109	78	54	44	25	101	30	9	11	6	4				150
409	424	507	384	266	127	41	1,307	392	117	169	69	34	3			151
330	341	335	292	352	210	79	123	49	40	9						152
41	15	7	18	7	8	4	48	13	4	2	2	4		1		153
																154
							11	2				1	1			155
5,104	4,157	2,576	1,807	1,064	370	48	13,683	4,287	1,842	1,477	569	251	109	34	5	156
114	165	335	124	32	11	1	276	71	3	35	18	8	7			157
2				1			92	40	28	8	4					158
1	1			1			16	4			4					159
26	24	10	4	5	2	1	46	12		9	3					160
24	11	9	9	7	5	1	158	46	23	12	9	2				161
							224	42	1	5	6	29			1	162
294	33	7	5	7	7	3	523	144	14	73	53	4				163
																164
							59	13		4	5	2	2			165
216	41	36	17	14	4	1	210	47	6	6	11	14	10			166

TABLE 67.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY SPECIFIED INDUSTRIES—NUMBER OF WAGE-ALL WAGE-EARNERS AND OF EACH CLASS, AVERAGE NUMBER OF MEN, WOMEN, AND CHILDREN

	INDUSTRY.	WOMEN 16 YEARS AND OVER (DISTRIBUTION OF NUMBER BY EARNINGS).					
		Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.
167	Iron and steel pipe, wrought	$87	20	12		3	
168	Iron and steel, steel works and rolling mills	6,032	1,013	84	74	201	193
169	Ivory and bone work	1,503	276	13	23	52	77
170	Japanning	745	146	36	15	28	30
171	Jewelry	30,207	4,374	177	240	525	763
172	Jewelry and instrument cases	2,011	399	55	80	99	48
173	Jute and jute goods	14,196	2,494	100	297	478	706
174	Kaolin and ground earths	183	39		15	17	3
175	Labels and tags	1,698	348	5	97	95	68
176	Lamps and reflectors	3,236	542	5	20	71	140
177	Lapidary work	90	11		1	1	
178	Lard, refined	99	18			16	1
179	Lasts	7	1				
180	Lead, bar, pipe, and sheet						
181	Leather goods	5,096	887	40	151	136	177
182	Leather, tanned, curried, and finished	7,421	1,306	42	76	119	457
183	Lime	12	2				1
184	Linen goods	4,780	867	17	34	141	245
185	Liquors, distilled	1,187	244	9	23	121	37
186	Liquors, malt	2,309	420	4	54	40	191
187	Liquors, vinous	558	85	4	18	15	7
188	Lithographing and engraving	6,907	1,243	52	222	303	198
189	Locomotives						
190	Looking-glass and picture frames	2,249	378	9	60	116	66
191	Lumber and timber products	1,577	302	49	57	40	43
192	Lumber, planing mill products, including sash, doors, and blinds	1,254	242	30	29	59	26
193	Malt						
194	Mantels, slate, marble, and marbleized						
195	Marble and stone work	346	70	13	14	10	11
196	Matches	2,777	502	26	69	101	121
197	Mats and matting						
198	Mattresses and spring beds	6,291	1,004	40	74	123	190
199	Millinery and lace goods	80,724	11,132	807	888	1,140	1,276
200	Mineral and soda waters	657	129	11	22	32	18
201	Mirrors	131	27		6	6	11
202	Models and patterns, not including paper patterns	849	111	5	2	14	11
203	Monuments and tombstones	51	6				3
204	Mucilage and paste	377	70	2	12	11	10
205	Musical instruments and materials, not specified	622	93	1	4	9	22
206	Musical instruments, organs	452	68	3	11	11	21
207	Musical instruments, pianos	1,668	288	3	13	58	81
208	Musical instruments, piano and organ materials	1,875	305	5	45	83	94
209	Needles, pins, and hooks and eyes	1,932	326	14	25	52	77
210	Nets and seines	3,383	633	36	88	123	158
211	Oakum	50	18	9	8	1	
212	Oil, cottonseed and cake	30	12	10			
213	Oil, essential						
214	Oil, linseed						
215	Oil, not elsewhere specified	208	24			3	1
216	Oilcloth and linoleum, floor	248	48		4	10	31
217	Oilcloth, enameled	41	7			3	2
218	Oleomargarine	47	7				1
219	Optical goods	4,611	790	19	32	165	181
220	Ordnance and ordnance stores						
221	Paints	3,395	597	25	115	96	109
222	Paper and wood pulp	37,329	6,377	162	343	1,140	1,107
223	Paper goods, not elsewhere specified	21,271	3,916	267	640	847	701
224	Paper patterns	5,002	767	107	87	140	113
225	Patent medicines and compounds	21,057	3,805	228	606	656	759
226	Paving materials						
227	Peanuts, grading, roasting, cleaning, and shelling	886	392	345	32	14	
228	Pencils, lead	3,491	693	63	181	108	84
229	Pens, fountain and stylographic	237	40	4	7	15	4
230	Pens, gold	21	2				
231	Perfumery and cosmetics	4,570	862	27	156	203	181
232	Petroleum, refining	188	33	3	3	3	7
233	Phonographs and graphophones	1,291	212	9	7	35	63
234	Photographic apparatus	1,649	264	15	11	40	45
235	Photographic materials	4,248	806	99	67	214	196
236	Photolithographing and photoengraving	1,623	250	6	45	67	27
237	Pickles, preserves, and sauces	17,775	4,106	919	609	1,142	669
238	Pipes, tobacco	718	128		30	24	32
239	Plated ware	1,534	256	15	27	38	49
240	Plumbers' supplies	1,025	174	11	4	15	58
241	Pocketbooks	1,365	235	2	25	49	62
242	Pottery, terra cotta, and fire clay products	10,975	1,928	108	303	449	402
243	Printing and publishing, book and job	78,433	11,988	860	1,313	1,607	1,808
244	Printing and publishing, music	466	71		9	7	5
245	Printing and publishing, newspapers and periodicals	77,851	13,093	1,119	1,896	1,974	2,326
246	Printing materials	58	9		2		2
247	Pulp goods	256	56		26	11	6
248	Pumps, not including steam pumps	19	4			3	
249	Refrigerators	16	2				
250	Regalia and society banners and emblems	6,376	948	22	87	140	119
251	Rice, cleaning and polishing						

EARNERS—MEN, WOMEN, AND CHILDREN—IN EACH GROUP OF EARNINGS, WITH EARNINGS AND NUMBER OF EMPLOYED DURING THE YEAR, AND NUMBER OF ESTABLISHMENTS: 1905—Continued.

WOMEN 16 YEARS AND OVER (DISTRIBUTION OF NUMBER BY EARNINGS)—continued.							CHILDREN UNDER 16 YEARS (DISTRIBUTION OF NUMBER BY EARNINGS).									
$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
4	1															167
175	146	75	29	26	8	2	$3,123	682	98	136	194	110	99	33	12	168
55	27	20	5	3	1		341	61	2	9	15	22	7	6		169
14	6	5	5	6			40	8			5	2		1		170
708	582	506	316	292	199	66	1,355	385	135	133	75	30	9	2	1	171
42	26	26	5	8	7	2	45	11	1	4	4	2				172
457	240	79	37	41	41	18	1,133	325	106	186	18	15				173
	3	1														174
40	33	5	2	2		1	93	29	11	11	7					175
164	98	30	2	11	1		195	43	3	12	12	11	4	1		176
3		2	1		2	1	27	6		4			1	1		177
						1	47	12		12						178
	1						11	3		1	2					179
																180
164	78	46	32	42	17	4	479	177	97	57	18	3			2	181
486	104	14	1	2	2	3	2,690	660	91	149	242	135	43			182
	1						46	17	7	8	1			1		183
287	71	62	7	2	1		777	192	25	35	61	50	16	4	1	184
24	12	10	3	2	[illegible]	1	82	20	2	2	16					185
60	43	19	9				1,069	285	63	99	70	20	27	6		186
7	7	7	6	5	9		73	17		4	12		1			187
187	117	48	44	55	14	3	393	105	8	60	22	5	8	2		188
							230	63	12	32	9	9		1		189
36	29	14	7	22	10	9	630	168	21	62	67	10	4	3	1	190
50	28	3	13	5	11	3	3,598	1,002	331	325	211	51	50	20	14	191
70	13	7	3	4	1		1,746	478	110	158	139	52	13	4	2	192
																193
																194
11	6	1	1	2	1		218	50	9	8	13	13	2	4	1	195
89	49	29	15	3			71	26	14	7	5					196
																197
186	115	85	87	73	26	5	330	97	24	44	22	3	2	2		198
1,745	1,278	1,035	813	908	764	478	620	185	80	48	34	15	8			199
24	9	[illegible]		1	2	1	1,159	364	124	128	79	17	12	4		200
2	1		1				36	11	2	6	2	1				201
21	15	10	12	12	7	2	136	31	5	7	7	8	3		1	202
1				1		1	22	9	4	4	1					203
23	5	6		1			59	16	3	2	9	2				204
30	10	5	5	5	2		237	62	10	26	15	10		1		205
4	4			7	7		14	5	3		2					206
50	48	19	6	7	3		659	175	23	82	35	29	6			207
54	16	3	2	2	1		818	219	12	141	49	6	2	5	4	208
69	43	20	9	14	2	1	58	17	2	15						209
132	63	21	7	4	1		85	25	3	22						210
																211
2							2	1	1							212
																213
																214
4	8	4	1		1	2	3	1		1						215
2		1					399	88	1	27	24	16	20			216
1		1														217
2	4						4	1			1					218
209	98	52	19	9	6		613	184	21	147	10	5	1			219
																220
80	76	43	12	30	6	5	46	12		10		1	1			221
2,424	718	296	131	26	19	11	884	182	21	23	51	31	48	3	5	222
624	371	230	112	92	22	10	608	154	28	49	55	12	4	6		223
108	62	45	18	25	22	40	26	7		6	1					224
606	423	158	139	156	53	21	878	244	88	70	47	10	9	9	11	225
																226
		1														227
124	75	25	18	12	3		118	33	2	26	5					228
7	5	2			2		7	2		1	1					229
			1		1											230
140	79	30	16	17	9	4	77	28	15	9	3		1			231
8	5	3	1				1,610	407	8	76	218	74	28	3		232
35	36	11	9	5	1	1	24	7		7						233
42	55	35	17	4			188	43	1	26	10	3	1	1	1	234
112	63	27	13	10	4	1	150	41	4	13	17	7				235
26	18	18	10	13	8	12	173	49	6	26	13	1	1	1	1	236
414	179	106	32	30	6		193	105	67	25	9	3	1			237
18	10	1	6	4	2	1	65	20	6	8	4	2				238
68	20	11	10	15	1	2	195	47	4	14	16	12	1			239
30	23	24	9	9		1	125	34	7	11	14	2				240
38	34	16	5	2	2		33	9		9						241
220	189	77	51	44	70	15	1,915	476	74	130	113	98	55	5	1	242
1,844	1,514	991	554	703	460	334	5,597	1,583	380	661	327	127	48	22	18	243
19	7	7	14	3			3	1		1						244
2,054	1,044	821	529	592	385	353	5,211	1,816	890	496	226	123	55	13	13	245
	1	4					22	5		1	3		1			246
10	3						45	15	3	12						247
1							28	8	3	3	1		1			248
1				1			18	5		4	1					249
163	168	118	70	39	18	4	61	20	9	9			2			250
																251

TABLE 67.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY SPECIFIED INDUSTRIES—NUMBER OF WAGE-
ALL WAGE-EARNERS AND OF EACH CLASS, AVERAGE NUMBER OF MEN, WOMEN, AND CHILDREN

	INDUSTRY.	WOMEN 16 YEARS AND OVER (DISTRIBUTION OF NUMBER BY EARNINGS).					
		Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.
252	Roofing materials	$10	5	4	1		
253	Rubber and elastic goods	34,805	4,980	157	300	586	797
254	Rules, ivory and wood	180	52	18	15	14	3
255	Saddlery and harness	3,167	622	63	116	105	151
256	Safes and vaults						
257	Salt	528	113	27	23	19	9
258	Sausage	78	13	1		1	3
259	Saws	78	13				8
260	Scales and balances	155	14				1
261	Screws, machine	417	83		9	27	36
262	Screws, wood	3,320	632	33	125	140	161
263	Sewing machine cases	104	17			2	10
264	Sewing machines and attachments	795	107		4	6	16
265	Shipbuilding, iron and steel	168	21		3	3	2
266	Shipbuilding, wooden, including boat building	58	8		1		
267	Shirts	75,166	13,206	1,650	1,789	1,924	2,144
268	Shoddy	1,462	301	24	41	55	65
269	Show cases	85	13				5
270	Silk and silk goods	108,596	17,763	1,301	2,102	3,015	2,848
271	Silversmithing and silverware	4,551	744	19	30	125	139
272	Slaughtering and meat packing, wholesale	10,067	1,550	74	52	278	265
273	Slaughtering, wholesale, not including meat packing	74	9		2		
274	Smelting and refining, copper						
275	Smelting and refining, lead	103	10				
276	Smelting and refining, zinc						
277	Smelting and refining, not from the ore	26	6	1		5	
278	Soap	9,140	1,870	123	503	419	298
279	Soda water apparatus	535	114	38	11	15	17
280	Sporting goods	5,020	872	59	147	125	92
281	Springs, steel, car and carriage						
282	Stamped ware	9,560	1,689	105	190	299	424
283	Starch	668	120	10	14	25	15
284	Stationery goods, not elsewhere specified	6,881	1,328	106	233	299	196
285	Statuary and art goods	226	38	1	9	9	5
286	Steam fittings and heating apparatus	337	63	4	14	5	15
287	Steam packing	676	127	1	32	34	26
288	Stencils and brands	152	20		1		6
289	Stereotyping and electrotyping	256	24	2	3	7	3
290	Stoves and furnaces, not including gas and oil stoves	188	23	1	1		
291	Stoves, gas and oil	81	14		1	5	3
292	Straw goods, not elsewhere specified	386	55			10	3
293	Structural ironwork	27	4				1
294	Sugar and molasses, refining	1,421	278	21	41	38	72
295	Sulphuric, nitric, and mixed acids						
296	Surgical appliances	1,919	311	9	10	62	48
297	Tin and terne plate	3,760	567	16	6	7	33
298	Tinfoil	1,402	286	7	77	61	57
299	Tinware	15,266	2,987	454	545	663	422
300	Tobacco, chewing and smoking, and snuff	28,598	5,901	1,678	966	669	679
301	Tobacco, cigars and cigarettes	205,232	34,374	3,779	4,358	5,576	5,528
302	Tools, not elsewhere specified	2,022	393	17	109	69	56
303	Toys and games	2,600	433	39	73	47	79
304	Trunks and valises	2,286	419	31	74	94	67
305	Turpentine and rosin	3	1		1		
306	Type founding	1,778	300	25	46	51	32
307	Typewriters and supplies	2,978	395	4	9	35	86
308	Umbrellas and canes	5,161	845	25	107	125	164
309	Upholstering materials	3,444	559	31	82	92	89
310	Varnishes	270	45	1	1	13	12
311	Vault lights and ventilators						
312	Vinegar and cider	386	92	13	13	39	19
313	Wall paper	1,285	255	13	64	52	52
314	Washing machines and clothes wringers	30	4				1
315	Watch and clock materials	898	135	9	6	12	13
316	Watch cases	3,265	542	17	89	96	112
317	Watches	22,099	2,474	16	76	117	149
318	Wheelbarrows						
319	Whips	1,633	278	39	14	33	26
320	Windmills						
321	Window shades and fixtures	2,590	470	45	68	63	90
322	Wire	544	98	6	11	11	24
323	Wirework, including wire rope and cable	9,248	1,478	57	164	240	225
324	Wood carpet	6	1				
325	Wood distillation, not including turpentine and rosin						
326	Wood preserving						
327	Wood, turned and carved	910	207	27	45	53	43
328	Woodenware, not elsewhere specified	2,218	452	75	35	144	63
329	Wool pulling						
330	Wool scouring	259	30			1	
331	Woolen goods	100,282	14,515	487	872	1,822	2,320
332	Worsted goods	136,451	20,138	523	636	2,786	4,554
333	All other industries	378	87	7	19	37	17

EARNERS—MEN, WOMEN, AND CHILDREN—IN EACH GROUP OF EARNINGS, WITH EARNINGS AND NUMBER OF EMPLOYED DURING THE YEAR, AND NUMBER OF ESTABLISHMENTS: 1905—Continued.

WOMEN 16 YEARS AND OVER (DISTRIBUTION OF NUMBER BY EARNINGS)—continued.							CHILDREN UNDER 16 YEARS (DISTRIBUTION OF NUMBER BY EARNINGS).									
$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
							$216	51	9	20	8	7	4	3		252
961	742	520	508	294	72	43	1,555	346	49	113	70	75	20	16	3	253
2							9	4	4							254
100	42	27	14	4			604	208	111	50	35	12				255
							60	13	1	4	3	2	3			256
13	13	3	1	4	1											257
3	3	1	1				14	4	1	2	1					258
	4			1			302	57	3	7	20	20	3	1	3	259
	2			2	8	1	71	17	2	2	10	2	1			260
7	3			1			314	76	6	19	36	15				261
99	40	22	5	7			159	44	7	28	6	3				262
5							1,029	227	23	58	50	61	35			263
21	20	9	14	16	1		65	21	10	10	1					264
4				4	5		1,209	358	127	131	71	27		1	1	265
3	2			2			37	10	1	3	4	2				266
1,724	1,413	1,057	693	501	242	69	1,578	683	591	80	6	4	1	1		267
112	2		2				9	4	2	1		1				268
2	5			1			38	10	1	4	2	2	1			269
2,660	1,976	1,401	1,052	775	475	158	8,882	2,835	1,206	955	429	159	73	9	4	270
207	98	55	26	13	14	9	337	97	14	44	25	8	6			271
526	148	69	80	26	16	16	2,816	612	57	102	284	50	75	26	18	272
2	1		1	2		1	47	8		2	1	1	1	1	2	273
							312	44	4	9	4	1	1	5	20	274
																275
			7	3			82	17		4	13					276
																277
213	197	35	29	21	20	12	553	145	33	22	60	17	8	3	2	278
15	6	2	6	2	1	1	10	3		2	1					279
151	104	73	55	39	24	3	155	44	3	26	11	1	3			280
							44	13	4	2	2	5				281
316	149	140	27	24	11	4	629	169	17	84	54	9	3	2		282
23	21	8	2	1	1		34	8	1	3	1		3			283
152	108	120	43	34	33	4	247	82	45	32	5					284
7	2	1	1		1	2	44	12	3	2	6	1				285
13	4	5		3			68	16	1	3	6	6				286
18	6	3	5	1		1										287
6	2	2			1	2	81	24	6	8	10					288
3		5	3	1	4	3	69	19	1	12	2	3	1			289
3	6	3	2	5	2		979	258	47	120	61	14	15		1	290
1	1	3					26	7	2		4		1			291
22	2	12	3	3												292
1	1	1					116	22	1	1	8	6	4	2		293
66	25	13	1	1			269	64	1	29	18	10			6	294
							15	3			2	1				295
104	20	21	13	7	13	4	39	10	2	4	1		3			296
201	286	18					12	2					2			297
40	25	14	3	2												298
296	240	136	88	90	40	13	1,012	283	41	145	78	8	10	1		299
777	385	238	165	227	104	13	3,707	1,561	1,248	162	102	33	11	4	1	300
4,801	3,799	2,178	1,490	1,575	941	349	9,711	3,238	1,649	914	388	184	73	18	12	301
57	37	15	23	9		1	439	106	20	23	26	19	14	3	1	302
79	48	32	16	18	1	1	676	190	35	91	42	9	9		4	303
60	22	27	17	23	3	1	426	118	23	49	25	13	8			304
							38	16	16							305
54	32	18	15	18	6	3	221	72	34	31	5	2				306
81	53	79	85	27	6		104	26	3	9	12	1	1			307
105	122	85	54	40	14	4	159	49	17	17	9	4	1	1		308
88	68	23	30	31	19	6	167	58	24	27	4		3			309
8	1	3		3	3		17	4			3	1				310
																311
3	3	1	1				22	6	1	2	2		1			312
46	13	11	2	1	1		664	184	20	122	30	10	2			313
	1	1		1			108	28	5	8	12	2		1		314
21	21	29	11	4	3	1	13	3			3					315
91	64	32	20	11	6	4	114	41	25	5	10			1		316
213	389	312	445	465	246	46										317
							2	1	1							318
72	44	28	9	9	2	2	265	62	20	13	9	4	8	3	5	319
																320
88	62	20	15	14	5		179	49	16	11	18		3	1		321
30	8	5	2	1			94	20	2	1	10	7				322
326	215	103	67	39	36	6	1,240	358	135	89	74	34	23	3		323
1							8	3	2		1					324
																325
							18	8	4	3	1					326
							652	177	35	70	50	12	6	3	1	327
27	8	3		1			834	217	63	50	36	36	22	9	1	328
84	26	17	5	2	1		7	1						1		329
4	1	1	23				36	6					6			330
2,400	1,992	1,406	1,383	1,317	450	66	8,280	2,164	465	760	535	268	99	28	9	331
4,659	1,917	1,544	1,315	1,373	653	178	16,893	4,422	925	1,693	1,289	339	146	24	6	332
5	1						6	2	2							333

TABLE 68.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY SPECIFIED INDUSTRIES—PER CENT DISTRIBUTION ... WAGE-EARNERS AND OF EACH CLASS, NUMBER OF ESTABLISHMENTS, AND PER CENT NUMBER OF ALL ...

	INDUSTRY.	Number of establishments.	Per cent number all wage-earners included in statistics of weekly earnings forms of greatest number, all establishments.	AVERAGE WEEKLY EARNINGS.				MEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).				
				All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.
1	All industries	123,703	47.0	$10.06	$11.16	$6.17	$3.46	2.2	2.2	3.4	4.0	6.2
2	Agricultural implements	362	49.2	10.90	10.97	5.75	3.12	1.4	1.5	2.4	3.0	5.2
3	Ammunition	[illegible]	17.1	8.60	10.65	6.05	5.21	0.9	0.1	2.5	5.5	4.6
4	Artificial feathers and flowers	90	35.1	6.71	10.80	6.20	3.29	2.7	3.9	5.5	4.7	5.5
5	Artificial limbs	67	71.3	12.76	13.26	6.73	4.29	0.8	3.6	0.8	2.4	2.8
6	Artificial stone	333	49.5	10.40	10.41	6.00	4.25	0.7	9.2	0.9	2.9	2.3
7	Artists' materials	12	25.3	7.28	8.84	4.97	2.60	......	1.7	13.8	5.2	8.6
8	Automobile bodies and parts	31	29.7	10.99	11.05	7.13	3.67	0.1	2.4	4.1	4.1	5.0
9	Automobiles	86	74.4	13.04	13.07	6.75	5.60	0.6	0.5	1.0	1.7	2.0
10	Awnings, tents, and sails	265	53.7	10.30	12.96	6.60	4.39	0.3	1.1	1.0	1.9	4.1
11	Axle grease	18	73.7	9.28	10.17	3.93	4.00	......	6.2	18.8	1.0	3.1
12	Babbitt metal and solder	42	45.8	10.67	10.73	6.83	......	0.3	0.8	0.3	0.3	5.5
13	Bags, other than paper	34	38.4	6.19	10.11	4.65	3.39	1.1	2.3	5.9	6.2	8.5
14	Bags, paper	28	31.4	7.37	9.73	4.89	2.33	1.9	5.7	2.8	8.5	8.1
15	Baking and yeast powders	102	49.4	9.07	11.85	6.10	3.00	0.7	0.5	3.0	2.6	5.1
16	Baskets, and rattan and willow ware	242	39.6	7.45	8.24	4.88	3.33	5.8	3.3	6.3	5.7	9.8
17	Beet sugar	19	39.3	14.90	14.96	10.75	9.22	0.4	0.1	0.1	0.1	0.1
18	Bells	13	62.6	9.72	10.23	6.18	4.56	0.9	0.6	4.3	3.7	6.7
19	Belting and hose, leather	84	62.9	11.45	11.54	6.35	2.50	0.4	1.1	2.3	3.8	4.4
20	Belting and hose, linen	11	32.4	6.78	11.69	5.05	3.71	......	......	1.5	5.9	4.4
21	Belting and hose, rubber	9	60.3	9.68	10.33	6.23	3.87	0.3	1.8	3.5	4.7	6.3
22	Bicycles and tricycles	69	33.1	11.78	11.86	8.50	3.62	0.7	1.0	3.6	3.2	4.5
23	Billiard tables and materials	35	33.3	11.59	12.07	4.63	3.60	......	......	0.6	1.3	2.6
24	Blacking	88	45.1	7.98	11.57	5.62	3.37	0.3	1.7	5.2	5.2	4.9
25	Bluing	31	37.8	7.13	8.93	4.90	3.86	......	3.3	6.6	4.9	11.5
26	Bone, ivory, and lamp black	14	35.7	12.13	12.51	4.50	......	1.2	......	......	......	16.2
27	Bookbinding and blank book making	526	42.4	8.96	12.13	6.13	3.67	0.9	3.4	5.4	6.1	6.8
28	Boot and shoe cut stock	232	72.7	8.02	9.63	5.05	3.59	1.3	2.8	4.0	5.6	7.7
29	Boot and shoe findings	154	66.9	7.37	8.70	5.63	3.52	3.6	4.3	5.7	9.0	10.2
30	Boot and shoe uppers	55	81.5	9.19	9.69	8.02	4.00	4.4	1.9	6.3	6.9	3.1
31	Boots and shoes	745	52.7	10.24	11.88	7.60	3.56	1.7	2.4	3.5	4.4	6.0
32	Boots and shoes, rubber	19	77.8	10.00	11.51	8.33	4.34	0.8	1.0	2.2	1.9	4.2
33	Boxes, cigar	150	40.5	7.25	8.97	5.87	3.00	2.4	5.1	5.5	8.0	9.8
34	Boxes, fancy and paper	389	42.1	6.69	9.95	5.48	2.93	2.1	4.1	5.8	7.6	8.3
35	Boxes, wooden packing	548	43.7	8.61	9.04	5.55	3.42	2.3	3.1	7.3	7.0	8.4
36	Brass	8	43.5	11.70	11.70	......	......	......	......	......	......	......
37	Brass and copper, rolled	18	73.7	11.58	11.82	6.30	5.23	1.2	0.7	1.5	1.4	2.8
38	Brass castings and brass finishing	329	50.1	11.28	11.43	5.41	4.63	1.7	2.3	2.8	3.2	5.5
39	Brassware	135	64.5	10.57	11.85	6.54	3.81	1.1	1.9	3.4	3.5	5.8
40	Bread and other bakery products	13,493	65.0	10.57	11.77	5.46	3.77	0.8	1.5	2.1	3.3	5.0
41	Brick and tile	2,053	36.2	9.70	9.82	5.55	3.74	3.0	1.9	3.0	3.0	6.7
42	Bronze castings	20	70.3	12.47	12.79	4.40	4.11	0.6	2.1	3.7	3.5	4.6
43	Brooms and brushes	765	50.6	7.76	9.60	4.28	3.32	2.4	4.0	5.4	5.7	9.7
44	Butter	3,333	61.5	10.93	11.06	5.79	3.35	1.1	1.5	2.1	3.8	5.9
45	Butter, reworking	23	66.3	11.16	11.31	5.88	4.00	3.1	2.2	0.9	0.3	1.8
46	Buttons	119	42.0	7.19	9.31	4.94	3.75	3.2	3.9	4.7	7.1	9.6
47	Calcium lights	14	60.8	9.97	10.32	6.67	......	......	......	......	17.8	10.7
48	Candles	9	43.4	8.02	9.83	4.36	3.57	1.8	3.2	0.7	4.3	7.2
49	Canning and preserving, fish	196	49.6	10.77	12.30	8.49	4.86	1.2	0.6	1.5	2.0	3.2
50	Canning and preserving, fruits and vegetables	598	23.9	6.78	9.14	5.40	3.24	7.8	3.3	3.3	4.5	8.3
51	Canning and preserving, oysters	13	4.1	5.63	6.27	4.04	3.11	13.1	16.0	15.0	16.9	11.4
52	Card cutting and designing	36	43.9	8.22	10.53	5.62	3.67	2.1	5.3	5.3	5.3	6.4
53	Carpets and rugs, other than rag	36	28.8	8.52	9.93	7.31	4.26	1.2	0.9	3.3	5.9	7.9
54	Carpets, rag	225	47.3	7.93	8.97	5.05	3.03	0.7	3.3	5.5	4.1	9.4
55	Carriage and wagon materials	346	51.0	9.55	9.71	5.09	4.47	2.4	2.2	4.2	4.5	9.0
56	Carriages and sleds, children's	40	40.9	9.20	9.45	6.26	3.59	1.9	2.6	3.6	4.8	8.4
57	Carriages and wagons	3,433	56.2	10.69	10.83	5.85	3.53	1.6	1.7	2.6	3.0	5.6
58	Cars and general shop construction and repairs by steam railroad companies	713	66.8	12.46	12.47	7.31	4.97	0.8	0.6	1.3	1.7	3.6
59	Cars and general shop construction and repairs by street railroad companies	43	53.7	12.53	12.55	7.35	4.00	1.5	0.8	1.5	1.8	1.8
60	Cars, steam railroad, not including operations of railroad companies	46	85.6	11.20	11.21	7.24	4.40	4.1	1.9	2.0	2.3	3.4
61	Cars, street railroad, not including operations of railroad companies	8	62.5	12.25	12.35	7.43	3.93	1.7	1.5	2.8	2.6	3.8
62	Cash registers and calculating machines	15	78.1	11.51	12.11	6.79	3.33	2.0	1.6	2.8	5.9	4.5
63	Cement	67	60.8	10.76	10.79	4.36	4.97	1.1	1.8	1.4	2.2	8.0
64	Charcoal	39	19.3	7.81	7.99	......	2.70	1.8	7.8	7.1	5.3	9.6
65	Cheese	2,226	72.9	10.74	10.90	5.16	3.37	0.6	1.0	2.5	4.7	6.3
66	Chemicals	155	50.8	10.55	10.91	5.18	4.74	1.0	0.8	1.0	1.3	2.0
67	China decorating	12	32.4	9.57	15.26	5.48	4.50	......	......	4.7	2.4	4.8
68	Chocolate and cocoa products	11	47.2	8.38	10.57	5.11	5.90	0.8	2.6	1.9	1.6	1.3
69	Cleansing and polishing preparations	84	62.8	8.45	10.52	4.68	3.40	1.0	3.8	5.2	3.4	8.9
70	Clocks	26	53.6	11.19	13.42	7.52	4.24	0.3	0.7	1.5	2.5	4.0
71	Cloth, sponging and refinishing	21	20.4	12.43	12.43	......	......	......	2.1	3.7	6.4	5.9

BUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—WITH AVERAGE WEEKLY EARNINGS OF ALL WAGE-EARNERS IN THE STATISTICS FORMS OF GREATEST NUMBER, ALL ESTABLISHMENTS: 1905.

MEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS)—continued.								WOMEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).											CHILDREN UNDER 16 YEARS (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).							
$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 to $20.	$20 to $25.	$25 and over	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
7.5	7.9	13.1	15.6	17.2	14.7	4.0	2.0	7.5	10.9	15.1	16.3	16.5	11.6	8.0	5.8	5.0	2.4	0.9	35.3	31.8	19.9	7.8	3.6	0.9	0.7	1
7.5	11.1	15.9	16.2	18.4	13.7	3.0	0.7	11.6	9.5	21.1	8.2	24.5	8.8	8.1	6.8	0.7	0.7		46.3	25.3	18.9	4.2	3.2	1.6	0.5	2
14.1	4.6	25.9	11.0	12.3	14.9	2.3	1.3	2.9	3.3	11.7	21.3	38.3	15.0	3.9	2.4	0.5		0.7		5.3	21.0	68.4		5.3		3
6.3	6.6	16.4	15.6	14.5	11.7	4.3	2.3	13.3	12.0	14.3	15.7	10.0	8.5	7.9	5.5	6.1	4.7	2.0	23.5	58.8	14.7	3.0				4
3.2	4.4	8.0	12.8	23.2	27.6	8.4	2.0				18.1	36.4	36.4	9.1					28.6	14.2		28.6	28.6			5
5.1	3.5	24.5	17.3	19.9	6.8	6.1	0.8					100.0								50.0	25.0		25.0			6
6.9	24.1	6.9	8.6	19.0	3.5		1.7	3.4		62.1	10.3		17.2	3.5		3.5			100.0							7
7.5	8.9	9.3	17.4	21.6	15.4	2.5	1.7				37.5		37.5		25.0				33.3	33.3		33.4				8
3.3	4.0	12.2	20.8	24.1	24.0	4.4	1.4				50.0	25.0			25.0				5.0	7.5	20.0	17.5	25.0	22.5	2.5	9
2.7	3.7	9.1	12.7	26.0	31.9	5.4	0.1	2.7	3.3	11.1	16.5	24.1	15.3	11.6	7.4	5.1	2.7	0.2	4.4	39.1	30.4		17.4	8.7		10
5.2	2.1	7.3	20.8	18.8	11.5	4.2	1.0		53.3	26.7		13.3	6.7								100.0					11
17.9	13.0	15.3	10.1	17.3	15.8	2.0	1.4			16.7		33.3	33.3			16.7										12
5.7	5.5	16.8	17.2	18.9	10.0	1.6	0.3	12.9	20.3	23.3	20.1	11.8	8.3	1.9	0.9	0.4	0.1		32.6	40.2	18.5	5.4	3.3			13
4.9	6.2	27.1	14.7	9.6	6.4	3.2	0.9	9.5	11.1	16.1	43.4	13.8	3.6	0.9	0.2	0.7	0.7		100.0							14
8.2	5.6	9.9	14.0	24.7	22.8	2.8	0.1	4.4	10.0	18.7	16.0	16.4	10.9	10.1	6.7	4.5	2.3		40.0	50.0		5.0	5.0			15
11.1	13.0	18.5	12.2	9.7	3.9	0.6	0.1	16.4	19.9	19.9	15.1	12.6	5.2	2.3	4.8	3.4	0.4		41.6	29.2	20.8	2.5	4.2		1.7	16
0.3	0.5	2.9	6.1	55.3	26.8	4.5	2.8						50.0				50.0						26.1		73.9	17
11.0	8.5	16.4	17.6	18.2	10.3	0.6	1.2	2.9		8.9	38.3	26.5	14.7	2.9	2.9		2.9		22.2	11.1	22.2		11.1	33.4		18
6.5	6.0	12.3	16.1	26.1	16.9	3.1	1.0			17.4	21.7	30.4	4.4	8.7	17.4				50 0	50.0						19
5.9	5.9	10.3	17.6	26.5	17.6	1.5	2.9	7.7	20.7	23.1	21.3	11.2	5.9	5.3	1.2	1.8	1.8		14 3	57.1	7.2	21.4				20
8.9	13.0	13.1	17.5	18.5	10.7	1.6	0.1	0.3	28.2	16.7	16.7	13.1	7.7	6.7	7.4	2.6	0.6		6.4	51.6	32.3	9.7				21
7.0	9.8	7.9	18.3	19.5	19.4	4.7	0.4		40.0					40.0			10.0	10.0	38.4	30.8	30.8					22
0.6	2.9	11.7	27.5	26.9	21.2	4.4	0.3	6.2	37.5	18.8	18.8	6.2				12.5				80.0		20.0				23
4.9	5.5	10.4	10.7	30.5	15.2	3.1	2.4	7.9	6.3	24.1	19.2	16.0	12.9	4.7	2.6	5.5	0.8		10.0	46.7	43.3					24
8.2	18.0	18.0	11.5	6.6	9.8	1.6		5.1	20.5	46.1	7.7	7.7	7.7		2.6	2.6				28.6	71.4					25
		8.8	5.0	46.3	16.2	6.3		25.0		25.0	25.0	25.0														26
5.4	5.7	6.7	10.8	15.5	23.5	7.6	2.2	3.3	12.5	15.7	17.2	18.7	12.6	8.3	5.1	3.7	2.0	0.9	19.6	43.0	20.7	13.4	1.4	0.8	1.1	27
9.5	8.8	11.0	17.4	21.2	8.9	1.6	0.2	10.6	15.0	18.3	22.8	17.8	7.2	3.6	2.2	2.0	0.4	0.1	27.1	39.6	18.8	10.1	3.9		0.5	28
10.1	9.6	11.0	13.3	15.4	6.3	1.1	0.4	8.8	10.4	17.2	19.2	20.4	10.7	5.3	2.9	3.1	1.9	0.1	29.4	30.4	26.5	8.8	4.9			29
13.8	5.0	8.2	17.6	17.0	14.5	1.3		3.4	5.1		10.2	5.1	28.8	10.2	10.2	11.8	11.8	3.4		50.0	50.0					30
6.6	6.9	9.0	14.6	19.6	18.3	5.1	1.9	4.6	6.8	9.3	11.6	12.2	12.4	10.5	9.9	11.8	7.9	3.0	32.3	30.9	24.2	7.7	3.9	0.6	0.4	31
5.8	6.4	18.3	17.8	19.8	18.1	3.1	0.6	1.8	1.9	6.8	8.3	11.0	14.6	14.4	21.8	15.2	4.0	0.2	22.8	24.6	24.0	16.7	6.3	4.8	0.8	32
9.4	9.5	11.3	15.8	15.5	6.4	1.1	0.2	7.3	17.4	16.8	16.7	14.2	10.7	7.5	4.8	4.1	0.5		54.1	28.6	14.3	2.0	1.0			33
7.0	7.9	10.7	16.2	15.5	11.3	2.7	0.8	9.6	16.7	17.8	16.9	14.5	9.8	6.0	4.1	3.2	1.1	0.3	47.1	40.3	8.2	3.3	0.8	0.3		34
10.2	9.7	15.5	15.0	13.8	6.6	0.9	0.2	8.2	17.2	14.4	15.7	13.4	13.4	5.1	5.6	3.7	2.6	0.7	31.5	36.6	22.0	6.0	2.6	0.7	0.6	35
	4.2	42.6	17.0	12.8	17.0	6.4																				36
4.5	6.8	26.6	21.0	17.0	10.6	3.6	2.3	5.8	6.6	8.9	15.8	30.5	15.5	10.3	4.6	1.4	0.6		2.9	5.7	54.3	11.4	14.3	8.5	2.9	37
5.5	7.2	10.1	19.3	16.6	22.4	2.8	0.6	3.8	16.2	24.8	23.8	17.2	4.8	3.8	3.8	0.9		0.9	19.4	27.4	48.4	1.6	1.6	1.6		38
5.6	6.9	15.4	13.9	17.7	17.6	4.5	2.7	4.8	7.6	12.2	15.4	21.4	17.0	11.5	6.2	3.4	0.4	0.1	14.8	40.3	34.1	9.7	1.1			39
4.7	5.7	7.5	16.2	27.6	21.9	3.0	0.7	7.5	15.6	17.3	17.9	17.8	10.1	5.4	3.7	3.4	1.1	0.2	29.0	30.6	16.9	11.0	6.3	2.7	3.5	40
8.6	9.1	22.6	18.1	15.1	6.6	1.5	0.8	18.2		27.2	18.2	9.1	9.1	9.1		9.1			28.2	28.4	21.7	9.1	9.8	1.7	1.1	41
6.9	8.0	10.6	17.5	16.5	14.1	5.6	6.3		40.0	33.3	20.0	6.7							33.3	33.3		22.3			11.1	42
8.1	8.0	11.4	16.6	17.4	9.0	1.7	0.6	20.6	21.1	25.2	12.2	10.3	5.6	2.1	1.3	1.3	0.2	0.1	31.9	35.8	20.1	8.9	3.0	0.3		43
8.1	7.8	9.4	17.2	23.1	16.9	2.2	0.9	11.0	6.6	13.2	19.1	22.1	8.1	8.1	5.2	2.9	2.2	1.5	52.2	17.4	8.7	13.1	4.3	4.3		44
1.8	7.9	13.7	30.5	24.4	7.9	4.0	1.5				12.5	87.5									100.0					45
9.7	10.2	12.6	13.1	12.8	10.6	1.9	0.6	19.5	12.3	19.5	14.4	13.3	10.0	5.8	2.6	1.8	0.5	0.3	27.2	32.0	27.2	12.4		1.2		46
	10.7	17.9	3.6	25.0	10.7	3.6			33.3		33.3						33.4									47
2.1	7.9	24.4	27.6	14.0	5.0	1.8		1.0	34.6	30.7	21.8	10.9	1.0						23.3	26.7	50.0					48
3.7	8.0	11.6	12.8	25.9	19.0	8.0	2.5	4.5	5.5	6.3	7.6	11.8	11.5	11.9	13.5	12.3	9.6	5.5	18.6	17.9	18.4	16.1	14.8	8.0	6.2	49
10.3	7.5	18.9	13.5	14.3	6.7	1.2	0.4	15.3	13.3	22.1	11.6	12.4	9.8	4.2	3.7	3.9	2.3	1.4	50.5	19.2	14.2	6.6	5.9	1.8	1.8	50
4.2	3.8	2.3	7.0	7.0	3.3			1.4	38.9	47.2	5.5	4.2	2.8							'00.0						51
6.9	5.3	10.1	14.9	20.8	11.7	4.3	1.6	2.6	12.6	19.2	30.5	15.2	4.6	8.6	2.0	4.0		0.7		66.7	33.3					52
14.3	12.4	11.9	15.6	15.9	8.4	1.5	0.8	2.7	2.6	9.9	18.4	13.6	13.8	12.9	11.9	11.7	2.4	0.1	14.4	29.3	38.7	13.7	2.1	1.4	0.4	53
11.6	10.4	18.6	16.3	16.0	4.0		0.1	9.3	18.1	23.0	16.5	15.7	6.5	7.3	1.6	2.0			35.9	41.0	20.5	2.6				54
11.0	9.5	14.9	16.3	15.6	9.0	1.1	0.3	7.9	10.7	28.8	22.6	16.4	6.2	4.0	1.7		0.6	1.1	17.8	16.1	32.2	12.7	16.6	2.3	2.3	55
10.7	14.2	14.7	17.9	12.7	8.1	0.1	0.3	2.9	6.9	12.8	17.6	28.4	11.8	6.9	7.8	4.9			46.9	12.5	15.6	18.8	6.2			56
7.6	6.7	15.4	16.3	21.6	15.2	2.2	0.5	5.2	13.4	15.0	18.2	17.4	14.9	8.5	4.4	1.9	0.6	0.5	34.0	26.4	23.9	12.9	2.2	0.3	0.3	57
5.1	8.8	12.7	18.3	19.8	19.6	6.1	1.6	0.5	10.4	1.4	1.4	30.5	23.9	13.3	12.1	6.5				34.0	6.2	45.4	8.2	5.2	1.0	58
3.3	4.2	9.3	15.7	34.2	23.2	2.2	0.5	5.9			5.9		35.3	52.9						50.0	25.0		25.0			59
4.8	8.4	20.9	17.1	15.6	14.0	3.8	1.7	0.7	10.1	4.3	15.8	5.8	30.9	15.1	9.3	5.8	2.2		6.0	18.0	60.0	16.0				60
5.4	6.1	13.0	16.3	19.9	17.8	6.5	2.6					28.6	57.1	14.3						50.0	40.0	10.0				61
5.3	7.8	8.7	11.7	19.5	23.3	5.3	1.6	0.5	2.1	14.9	21.2	18.6	16.5	12.7	7.6	3.6	2.1	0.2		66.7	33.3					62
11.1	13.3	12.0	16.5	19.6	10.3	2.2	0.5	18.2	36.3	18.2	18.2				9.1				3.2	19.4	30.6	40.3	6.5			63
4.3	1.8	34.7	24.8	2.5	0.3														70.0	30.0						64
9.9	7.5	9.5	20.3	19.6	13.7	3.6	0.8	11.3	16.1	29.0	9.7	14.5	6.5	3.2		6.5	3.2		36.8	31.6	15.8	10.5	5.3			65
4.4	9.3	24.1	23.3	19.6	10.8	1.7	0.7	10.5	20.3	16.9	17.7	11.1	9.3	5.8	3.7	3.2	1.3	0.2	6.4	9.7	45.2	19.4	9.7	6.4	3.2	66
4.8	4.8	2.4	4.8	16.6	26.2	19.0	9.5	10.7	25.0	17.8	19.6	5.4	10.7	5.4		1.8		3.6			50.0	50.0				67
4.0	3.4	6.4	6.5	58.3	10.6	2.3	0.3	2.8	6.3	10.2	34.0	40.6	2.1	2.0	1.8	0.2					10.0	60.0	10.0	20.0		68
5.2	6.2	11.7	18.5	17.2	15.5	1.7	1.7	11.1	31.3	17.0	15.0	12.4	3.3	5.2	3.3	0.7	0.7		40.0	40.0		20.0				69
4.7	5.8	8.1	13.9	22.4	30.5	4.3	1.3	0.5	1.6	5.1	12.5	14.1	23.0	26.2	12.1	4.4	0.3	0.2	7.4	37.7	40.2	11.3	3.4			70
2.7	6.4	8.6	14.4	21.4	18.2	5.4	4.8																			71

TABLE 68.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY SPECIFIED INDUSTRIES—PER CENT DISTRI- WAGE-EARNERS AND OF EACH CLASS, NUMBER OF ESTABLISHMENTS, AND PER CENT NUMBER OF ALL

	INDUSTRY.	Number of establishments.	Per cent number all wage-earners included in statistics of weekly earnings forms of greatest number, all establishments.	AVERAGE WEEKLY EARNINGS.				MEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).				
				All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.
72	Clothing, horse	12	21.6	$7.68	$9.08	$6.73	......	......	19.0	6.0	6.9	4.3
73	Clothing, men's	1,697	29.9	8.50	12.23	6.07	$2.98	0.9	2.2	3.1	4.0	5.2
74	Clothing, men's, buttonholes	92	32.6	8.64	10.77	5.80	3.36	......	1.8	2.1	9.7	4.7
75	Clothing, women's	1,072	27.1	9.01	13.52	6.85	3.49	0.6	1.2	1.6	2.9	4.1
76	Coffee and spice, roasting and grinding	278	49.1	9.12	11.80	5.48	3.42	1.1	1.6	1.8	2.3	3.2
77	Coffins, burial cases, and undertakers' goods	137	51.5	9.91	10.71	6.30	3.94	1.4	2.5	3.8	3.3	6.9
78	Coke	120	63.8	10.28	10.31	......	4.19	1.9	1.7	2.4	3.5	5.9
79	Collars and cuffs	9	55.0	8.02	10.21	7.67	3.47	3.3	5.0	7.6	8.1	9.1
80	Combs	22	38.2	9.16	9.77	6.36	4.53	1.3	2.5	3.4	6.6	6.5
81	Condensed milk	48	58.8	9.23	10.88	6.78	3.38	1.7	1.4	1.4	2.3	2.9
82	Confectionery	816	42.7	6.76	10.27	4.83	3.08	1.4	3.4	5.3	6.3	11.1
83	Cooperage	932	48.0	9.85	9.97	3.81	3.38	2.9	2.4	4.0	5.7	7.7
84	Coppersmithing and sheet iron working	1,263	46.0	12.85	12.96	5.78	4.05	1.4	1.5	2.6	3.0	4.2
85	Cordage and twine	57	44.3	6.88	8.42	5.48	3.27	1.1	2.4	7.2	7.7	11.2
86	Cordials and sirups	41	37.1	5.96	10.53	3.99	4.00	......	1.3	2.6	3.9	6.5
87	Cork, cutting	25	27.8	6.21	8.09	4.77	2.53	......	4.2	20.3	8.3	9.1
88	Corsets	57	42.7	7.13	16.99	6.13	3.27	0.4	0.7	2.1	5.0	2.7
89	Cotton goods	525	57.5	6.47	7.71	6.03	3.21	4.1	5.4	10.3	11.4	15.0
90	Cotton small wares	40	44.9	7.45	10.10	6.32	3.23	1.1	6.0	6.7	4.8	8.3
91	Cotton waste	20	26.4	8.21	10.22	4.64	......	1.1	......	......	1.8	5.3
92	Crucibles	8	72.7	10.76	10.76	......	......	1.3	0.8	1.3	1.7	2.1
93	Cutlery and edge tools	129	45.1	10.28	10.96	6.31	3.86	2.1	1.8	3.5	5.0	6.2
94	Dairymen's, poulterers', and apiarists' supplies	98	40.6	8.76	9.46	4.77	3.94	0.8	9.8	4.8	4.0	6.0
95	Dentists' materials	44	26.7	10.40	13.62	6.38	3.70	0.3	0.9	0.9	4.7	1.9
96	Drug grinding	16	74.6	10.05	11.20	4.15	4.00	......	......	0.9	0.7	2.1
97	Druggists' preparations	134	39.4	7.25	10.00	5.39	2.66	0.8	2.3	4.4	7.5	9.2
98	Dyeing and finishing textiles	179	50.5	8.71	9.51	5.99	4.19	0.9	1.5	2.7	4.7	8.7
99	Dyestuffs and extracts	57	47.2	9.24	9.27	5.25	2.33	2.2	2.1	1.2	4.4	17.6
100	Electrical machinery, apparatus, and supplies	443	47.1	9.88	10.85	6.37	3.67	3.1	2.3	3.1	4.4	5.0
101	Electroplating	229	56.6	11.65	12.07	6.71	3.76	0.5	2.1	3.5	4.5	4.4
102	Emery wheels	24	78.1	11.74	11.83	6.44	3.50	1.0	1.0	1.4	2.7	4.1
103	Enameling and enameled goods	54	13.8	8.52	10.16	5.84	3.83	1.4	1.8	1.8	2.6	7.6
104	Engravers' materials	7	73.6	12.92	12.92	......	......	......	......	2.6	5.1	......
105	Engraving and diesinking	182	50.9	13.71	14.46	6.02	3.28	2.4	2.7	4.1	3.9	4.5
106	Engraving, steel, including plate printing	116	33.1	12.02	15.54	6.01	3.50	1.4	4.0	3.9	4.7	4.1
107	Engraving, wood	49	37.9	12.86	13.09	3.00	4.00	3.2	7.6	4.4	7.6	5.1
108	Envelopes	36	66.0	7.88	12.08	6.44	3.33	0.2	2.9	2.7	3.5	4.6
109	Explosives	28	12.8	13.40	13.71	5.47	......	2.5	1.5	1.6	2.2	1.7
110	Fancy articles, not elsewhere specified	172	43.4	8.27	11.18	5.50	2.80	2.4	6.2	7.1	6.2	8.0
111	Felt goods	18	53.8	7.76	8.06	6.24	4.60	1.1	1.0	1.5	2.1	6.2
112	Fertilizers	200	50.5	7.32	7.34	5.96	2.75	6.5	5.7	6.7	14.0	16.5
113	Files	42	67.1	9.95	10.52	6.63	4.00	1.0	2.1	2.9	5.6	8.0
114	Firearms	20	70.0	11.90	12.00	7.38	3.42	1.0	0.9	1.7	3.1	6.0
115	Fire extinguishers, chemical	26	55.0	12.22	12.26	8.00	......	......	......	......	5.0	1.7
116	Fireworks	19	32.2	7.40	9.13	5.23	2.63	4.2	2.9	5.8	12.8	8.4
117	Flags and banners	16	36.1	5.72	7.67	4.93	5.00	1.8	10.9	10.9	5.5	9.1
118	Flavoring extracts	219	59.1	7.57	10.33	4.87	3.00	1.8	3.1	5.8	6.2	7.5
119	Flax and hemp, dressed	7	31.3	5.81	5.81	......	......	10.9	10.9	17.3	17.3	16.4
120	Flour and grist mill products	7,382	63.8	9.99	10.03	6.39	3.29	1.2	1.8	3.0	3.1	10.5
121	Food preparations	445	39.2	8.24	10.27	5.36	4.08	1.7	1.9	2.2	3.9	7.3
122	Foundry and machine shop products	5,359	57.8	11.79	11.88	5.83	4.01	1.4	1.9	2.6	2.8	4.3
123	Foundry supplies	25	57.9	10.11	10.41	4.75	3.67	2.9	1.4	1.4	3.8	4.3
124	Fur goods	448	36.3	11.31	13.69	8.60	3.38	0.3	1.1	2.1	3.6	4.5
125	Furnishing goods, men's	230	47.0	6.62	11.30	6.06	2.99	1.6	3.2	5.5	7.2	6.4
126	Furniture	1,257	44.3	9.86	10.16	5.53	3.55	1.7	2.3	3.9	4.5	7.4
127	Furs, dressed	28	34.8	14.13	14.48	7.73	3.75	0.6	1.0	1.0	1.6	3.2
128	Galvanizing	22	37.4	10.28	10.36	......	5.91	1.9	2.2	1.1	3.9	1.2
129	Gas and lamp fixtures	148	49.4	10.66	12.43	5.94	4.08	0.8	2.7	4.7	4.5	7.4
130	Gas, illuminating and heating	619	44.7	10.65	10.65	7.40	2.29	5.6	2.3	2.5	2.0	4.9
131	Gas machines and meters	59	52.2	12.08	12.45	5.81	4.00	0.8	1.8	2.3	3.7	4.2
132	Glass	171	41.5	12.82	14.10	5.08	4.22	1.8	2.5	4.7	5.3	5.4
133	Glass, cutting, staining, and ornamenting	264	46.2	11.15	11.90	5.41	3.57	0.5	4.3	5.5	5.1	5.4
134	Gloves and mittens, leather	136	37.2	7.95	10.28	6.30	3.24	2.3	2.2	3.9	3.9	7.1
135	Glucose	8	88.8	11.87	12.07	6.45	5.06	1.6	0.4	0.9	1.1	1.7
136	Glue	37	50.5	9.34	10.00	5.22	3.63	1.7	2.0	2.1	1.3	3.6
137	Gold and silver, leaf and foil	42	24.2	10.05	14.22	6.14	4.13	......	2.7	4.3	3.3	3.3
138	Gold and silver, reducing and refining, not from the ore	28	49.2	13.29	13.33	7.00	......	......	......	......	0.7	1.3
139	Graphite and graphite refining	6	19.5	10.22	10.81	4.00	......	......	......	......	......	......
140	Grease and tallow	228	53.2	11.12	11.14	5.40	5.00	1.6	0.7	1.0	0.7	3.1
141	Grindstones	10	38.8	10.33	10.33	......	......	0.8	0.5	......	......	1.0
142	Gypsum wall plaster	102	55.6	10.40	10.46	6.68	4.22	4.8	1.7	2.3	2.8	5.4
143	Hairwork	69	35.5	7.71	11.81	6.59	3.33	......	......	4.0	4.0	6.7
144	Hammocks	3	3.2	6.58	9.00	4.17	......	......	......	......	16.6	16.7
145	Hand knit goods	33	40.9	5.97	7.76	5.64	2.75	......	......	10.5	18.4	23.7
146	Hand stamps	143	68.9	10.89	12.11	7.20	3.93	0.5	4.6	5.8	5.4	5.6

[1] Less than one-tenth of 1 per cent.

BUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—WITH AVERAGE WEEKLY EARNINGS OF ALL WAGE-EARNERS IN THE STATISTICS FORMS OF GREATEST NUMBER, ALL ESTABLISHMENTS: 1905—Continued.

MEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS)—continued.								WOMEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).											CHILDREN UNDER 16 YEARS (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).							
$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 to $20.	$20 to $25.	$25 and over	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
6.0	11.2	6.0	17.3	10.4	11.2	1.7	.....	.....	.....	20.5	13.4	19.3	18.1	11.7	6.4	7.6	1.8	1.2	.....	.....	.....	.....	.....	.....	.....	72
6.0	6.7	7.7	14.9	18.2	19.2	9.3	2.6	8.3	10.3	13.4	17.5	17.7	11.6	8.1	5.9	4.7	1.9	0.6	51.6	31.1	12.3	2.6	1.7	0.7	.....	73
7.2	5.0	10.1	20.9	25.9	9.0	2.9	0.7	2.1	6.9	13.2	28.6	22.7	18.0	4.8	2.1	1.1	0.5	.....	27.3	36.3	27.3	9.1	.....	.....	.....	74
5.3	7.1	8.8	15.3	19.1	18.3	9.2	6.5	6.1	8.4	11.6	13.5	15.7	12.5	10.5	7.4	7.8	4.3	2.2	28.8	36.6	22.3	11.5	0.8	.....	.....	75
5.4	6.6	9.2	19.8	26.9	16.5	3.7	1.9	2.5	11.2	23.9	25.0	17.4	10.8	5.2	1.6	1.7	0.6	0.1	49.1	15.8	28.1	1.7	5.3	.....	.....	76
6.4	6.7	13.1	18.2	20.2	15.2	1.8	0.5	5.3	8.6	17.1	11.1	18.9	13.6	8.7	7.2	5.6	3.3	0.6	21.7	28.3	30.4	13.0	4.4	2.2	.....	77
6.0	10.7	12.0	28.2	19.8	6.4	1.2	0.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9.7	41.7	31.9	5.5	4.2	4.2	2.8	78
8.5	6.0	8.1	13.6	12.5	11.8	3.1	3.3	5.9	9.6	8.7	8.9	10.8	10.8	11.1	8.9	12.1	9.1	4.1	7.0	64.0	24.0	4.0	1.0	.....	.....	79
9.3	8.6	13.0	18.7	23.2	5.9	0.7	0.3	1.0	2.0	8.1	29.3	28.3	20.2	4.0	5.1	1.0	1.0	.....	8.8	5.9	41.2	29.4	8.8	5.9	.....	80
4.4	5.7	18.8	28.1	22.3	8.7	1.5	0.8	2.4	5.3	10.2	15.2	25.7	12.3	15.0	6.6	4.0	3.2	0.1	43.0	27.8	16.5	3.8	3.8	5.1	.....	81
10.2	7.8	9.1	13.2	14.8	12.2	3.5	1.7	10.3	25.7	20.8	18.0	11.8	6.3	3.1	1.7	1.4	0.6	0.3	44.6	44.5	6.8	2.7	1.0	0.1	0.3	82
11.9	7.8	12.3	15.7	15.0	11.7	2.3	0.6	42.7	14.3	4.8	14.3	14.3	4.8	.....	.....	4.8	.....	.....	51.2	15.2	10.7	13.1	6.5	2.5	0.8	83
5.6	5.3	10.5	10.3	15.2	26.1	13.3	1.0	4.0	20.8	19.8	17.8	10.9	5.9	3.0	8.9	6.9	2.0	.....	10.7	34.5	28.5	15.5	4.8	1.2	4.8	84
20.3	16.7	10.3	9.2	6.9	6.3	0.6	0.1	2.1	14.4	26.4	23.5	21.2	8.5	2.5	0.8	0.4	0.2	.....	40.2	36.9	12.9	5.7	3.2	1.1	.....	85
19.0	9.8	5.9	12.4	23.5	11.1	3.3	0.7	21.2	34.6	21.2	12.7	6.8	2.6	0.6	.....	0.3	.....	.....	.....	.....	100.0	.....	.....	.....	.....	86
10.3	8.7	11.7	14.3	8.1	4.4	0.2	0.4	0.3	17.9	39.2	22.5	11.1	5.6	3.4	.....	.....	.....	.....	35.2	62.5	2.3	.....	.....	.....	.....	87
2.9	2.9	9.7	12.0	27.5	18.0	8.8	7.3	9.2	9.4	10.1	13.1	16.8	12.3	10.2	9.0	6.7	2.4	0.8	27.8	51.8	7.4	9.3	3.7	.....	.....	88
13.5	9.7	8.9	10.0	7.4	3.0	0.9	0.4	6.2	10.5	14.6	16.7	18.1	13.9	9.9	6.0	3.7	0.4	(1)	45.2	30.1	16.5	5.4	2.1	0.4	0.3	89
10.8	8.1	11.1	11.9	17.5	8.4	3.2	2.1	2.5	6.8	11.9	17.7	25.2	15.2	9.8	6.5	3.0	1.3	0.1	20.0	64.6	9.1	3.4	1.7	0.6	0.6	90
6.4	11.7	38.3	22.3	7.8	4.6	0.7	.....	1.3	7.5	44.0	22.0	19.5	2.5	1.3	1.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	91
5.1	12.0	26.1	24.4	17.1	4.3	3.4	0.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	92
7.6	7.9	10.2	15.0	21.3	15.3	3.2	0.9	4.5	11.9	14.1	23.3	23.4	12.4	5.1	1.9	1.5	1.0	0.9	22.3	32.3	19.9	17.9	4.0	0.8	2.8	93
11.2	8.5	12.2	12.8	19.7	9.0	1.0	0.2	4.9	27.3	31.7	12.2	10.7	6.3	3.4	1.0	1.5	1.0	.....	16.6	27.8	38.9	5.6	11.1	.....	.....	94
3.7	4.0	7.1	11.2	25.4	29.4	6.2	4.3	7.9	2.3	10.8	13.6	16.4	39.7	3.7	2.8	2.3	.....	0.5	11.1	44.5	33.3	.....	7.4	3.7	.....	95
3.0	4.1	45.8	20.8	13.6	6.2	1.6	1.2	47.3	15.3	9.2	11.4	9.9	4.6	2.3	.....	.....	.....	.....	.....	.....	100.0	.....	.....	.....	.....	96
9.9	9.2	13.5	15.0	12.4	12.4	2.0	1.4	2.4	14.6	26.7	22.3	16.7	8.4	4.6	2.2	1.1	0.7	0.3	57.8	32.8	7.8	1.6	.....	.....	.....	97
21.0	13.1	13.1	17.0	9.9	4.3	1.1	2.0	4.0	6.3	17.5	20.1	33.4	8.4	4.7	3.3	1.8	0.3	0.2	8.0	27.2	47.0	15.0	2.3	0.5	.....	98
10.7	7.7	20.7	17.7	11.0	3.3	1.0	0.4	25.0	.....	.....	.....	50.0	25.0	.....	.....	.....	.....	.....	66.7	33.3	.....	.....	.....	.....	.....	99
6.5	9.1	10.1	15.2	20.0	16.4	3.7	1.1	4.6	7.2	13.2	17.9	18.8	17.4	12.1	4.8	3.2	0.8	(1)	25.2	32.8	26.4	9.0	3.8	1.7	1.1	100
4.8	3.9	6.9	13.3	22.1	29.9	3.5	0.6	3.9	9.8	5.9	5.9	33.3	7.9	9.8	17.6	5.9	.....	.....	8.1	40.5	35.2	16.2	.....	.....	.....	101
5.5	6.8	15.6	18.2	22.3	18.3	2.7	0.4	.....	.....	22.2	11.2	22.2	22.2	22.2	.....	.....	.....	.....	.....	100.0	.....	.....	.....	.....	.....	102
13.7	14.5	11.2	21.0	11.2	10.1	2.4	0.7	3.1	18.3	18.7	14.8	13.2	15.6	6.1	4.5	4.3	0.6	0.8	12.5	57.5	27.5	.....	.....	2.5	.....	103
.....	10.2	5.1	15.4	30.8	23.1	5.1	2.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	104
3.3	2.6	3.5	8.4	14.1	26.0	16.3	8.2	2.3	11.7	16.3	9.3	37.2	7.0	2.3	2.3	9.3	2.3	.....	37.5	25.0	31.2	.....	6.3	.....	.....	105
4.4	3.7	5.7	6.2	14.1	22.1	11.6	14.1	5.0	18.4	13.7	13.0	10.8	18.4	13.0	2.1	3.3	1.6	0.7	6.7	63.3	25.0	3.3	.....	.....	1.7	106
2.5	4.4	3.8	8.2	8.9	20.9	13.9	9.5	.....	100.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	33.3	33.3	33.4	.....	.....	.....	107
5.3	5.1	10.9	14.3	20.2	23.3	6.2	0.8	2.6	9.5	11.3	15.3	21.8	17.6	10.9	6.8	3.3	0.8	0.1	29.8	31.5	29.8	6.5	1.6	0.8	.....	108
4.4	8.9	11.7	9.0	23.1	17.1	5.9	10.4	.....	15.6	28.1	18.8	12.5	12.5	3.1	3.1	6.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	109
8.2	4.6	8.8	10.2	13.5	13.8	6.1	4.9	13.3	17.9	19.3	14.8	12.9	7.9	4.3	3.9	3.2	1.8	0.7	35.5	48.7	9.5	3.8	1.9	0.6	.....	110
16.4	34.9	15.2	9.7	7.1	3.7	0.8	0.3	2.8	6.2	9.3	16.8	31.8	14.6	6.3	6.5	4.4	1.3	.....	.....	20.0	60.0	20.0	.....	.....	.....	111
13.0	9.1	7.6	11.9	6.2	2.2	0.5	0.1	14.8	23.9	1.1	10.2	14.8	10.2	14.8	1.1	5.7	3.4	.....	47.5	42.5	7.5	2.5	.....	.....	.....	112
7.5	10.6	11.9	17.4	22.2	8.3	1.5	1.0	1.6	4.7	15.6	9.9	16.1	17.7	15.1	13.6	5.7	.....	.....	5.5	38.4	51.7	4.4	.....	.....	.....	113
8.3	8.6	9.9	18.0	18.3	18.2	4.0	2.0	.....	15.4	7.7	.....	19.2	19.2	7.7	3.9	19.2	7.7	.....	14.0	44.1	27.9	14.0	.....	.....	.....	114
10.7	7.4	7.4	19.8	19.8	17.4	8.3	2.5	.....	.....	.....	.....	.....	.....	100.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	115
12.6	7.3	8.1	14.4	13.6	6.8	2.6	0.5	6.5	19.2	21.5	19.5	18.0	4.6	6.5	2.3	1.5	.....	0.4	94.7	5.3	.....	.....	.....	.....	.....	116
14.5	12.8	20.0	3.6	3.6	7.3	.....	.....	14.2	25.4	9.7	21.6	12.7	6.7	1.5	4.5	1.5	2.2	.....	.....	50.0	.....	.....	50.0	.....	.....	117
5.3	6.2	8.9	16.3	17.6	14.8	5.0	1.5	6.9	14.2	18.5	26.5	21.9	6.6	2.8	1.7	0.7	0.2	.....	28.6	28.6	35.7	7.1	.....	.....	.....	118
7.2	1.8	16.4	1.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	119
9.8	6.4	17.8	17.9	16.5	9.4	1.8	0.8	6.3	9.2	11.5	25.3	19.5	2.9	4.0	2.3	14.4	4.0	0.6	37.0	32.9	17.8	5.5	5.5	1.3	.....	120
7.7	7.6	14.4	22.2	19.2	9.1	2.0	0.8	7.8	15.6	22.3	18.6	18.9	6.9	4.5	2.4	2.1	0.7	0.2	23.5	28.5	17.7	13.7	10.8	2.9	2.9	121
6.1	7.6	12.7	15.0	18.7	21.1	4.5	1.3	3.5	10.3	17.3	25.3	20.3	11.7	4.3	3.2	2.6	0.9	0.6	17.4	36.3	29.7	8.0	5.0	1.4	2.2	122
5.8	4.8	24.5	20.7	18.3	9.2	2.9	.....	.....	25.0	25.0	12.5	37.5	.....	.....	.....	.....	.....	.....	.....	66.7	33.3	.....	.....	.....	.....	123
4.8	7.0	7.5	12.8	18.4	20.3	9.2	8.4	1.7	3.5	5.8	8.6	13.2	10.7	12.5	10.9	15.3	12.8	5.0	33.3	33.3	29.2	.....	.....	.....	4.2	124
6.4	6.5	6.8	17.1	13.9	17.2	5.3	2.9	9.2	11.5	14.4	18.8	16.3	9.3	6.5	4.5	5.3	2.8	1.4	31.6	59.9	5.1	1.1	2.3	.....	.....	125
10.5	9.8	13.7	15.2	17.4	11.1	2.0	0.5	13.7	14.2	13.2	18.5	13.7	10.9	6.2	3.5	3.2	2.2	0.7	30.5	32.9	20.8	11.9	3.3	0.5	0.1	126
4.8	4.8	9.8	15.0	17.4	21.8	7.2	11.8	6.7	.....	.....	6.7	26.6	6.7	20.0	.....	26.6	6.7	.....	.....	62.5	25.0	12.5	.....	.....	.....	127
3.7	25.6	14.4	21.4	15.8	7.0	1.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	72.7	27.3	.....	.....	128
4.2	4.4	6.9	10.7	21.2	23.1	6.9	2.5	3.9	8.5	19.1	16.8	20.9	13.7	10.7	3.8	2.0	0.5	0.1	10.0	27.6	49.2	13.2	.....	.....	.....	129
4.2	5.4	18.6	18.1	19.1	14.9	1.9	0.5	.....	.....	20.0	4.0	4.0	8.0	48.0	4.0	8.0	4.0	.....	71.4	14.3	14.3	.....	.....	.....	.....	130
3.4	6.3	8.8	15.0	24.6	23.1	5.5	0.5	11.8	11.8	20.0	16.5	5.9	16.5	10.6	3.5	2.3	1.1	.....	.....	50.0	50.0	.....	.....	.....	.....	131
5.8	6.2	10.6	12.8	11.5	10.9	7.5	15.0	9.9	21.7	25.0	14.7	11.7	6.7	3.5	2.9	1.7	1.4	0.8	13.0	30.4	30.1	14.8	9.0	1.2	1.5	132
5.8	4.6	6.1	10.4	20.7	23.9	6.1	1.6	4.2	20.8	25.2	16.8	11.9	7.2	4.9	4.5	2.5	1.0	1.0	15.9	55.1	15.9	11.2	1.9	.....	.....	133
8.6	8.4	15.6	16.3	18.5	10.5	2.3	0.4	12.8	8.4	13.8	10.4	14.6	9.7	10.2	8.4	7.0	3.7	1.0	30.2	57.0	8.2	2.3	2.3	.....	.....	134
1.7	1.2	17.2	26.8	31.7	11.6	3.4	0.7	1.7	.....	15.5	27.6	0.9	53.4	.....	.....	0.9	.....	.....	.....	.....	56.3	31.2	12.5	.....	.....	135
4.3	9.5	31.9	18.6	16.7	6.4	1.6	0.3	20.2	4.9	15.3	15.3	24.6	11.8	7.4	0.5	.....	.....	.....	26.7	36.7	33.3	3.3	.....	.....	.....	136
4.3	4.3	2.7	6.5	6.5	50.8	9.7	1.6	1.1	5.4	15.7	30.8	16.2	13.5	10.8	1.1	3.3	1.6	0.5	.....	37.5	25.0	37.5	.....	.....	.....	137
1.3	0.7	9.1	18.9	35.3	26.1	4.6	2.0	.....	.....	.....	.....	.....	100.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	138
2.4	.....	57.1	16.7	16.7	4.7	.....	2.4	.....	50.0	25.0	25.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	139
4.5	6.4	15.4	26.6	27.6	10.9	1.2	0.3	.....	.....	40.0	.....	60.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	100.0	.....	.....	.....	140
0.3	5.5	53.5	25.4	6.8	6.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	141
4.3	4.7	17.6	28.0	15.2	11.0	1.5	0.7	5.9	2.9	2.9	.....	73.6	5.9	.....	.....	.....	8.8	.....	11.1	55.6	.....	.....	22.2	.....	11.1	142
6.7	6.7	8.0	14.6	24.0	18.7	5.3	1.3	3.8	8.3	7.9	15.8	18.9	17.0	10.2	6.0	8.3	3.0	0.8	.....	66.7	33.3	.....	.....	.....	.....	143
.....	.....	.....	50.0	16.7	.....	.....	.....	33.3	.....	16.7	33.3	16.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	144
2.6	13.2	2.6	18.4	5.3	5.3	.....	.....	2.4	13.0	11.8	11.8	50.3	4.7	3.0	3.0	.....	.....	.....	50.0	50.0	.....	.....	.....	.....	.....	145
4.0	4.0	6.8	10.7	17.5	24.4	7.9	2.8	2.1	1.0	11.7	17.0	24.5	12.8	14.9	3.2	5.3	4.3	3.2	1.8	47.4	40.3	3.5	.....	1.8	5.2	146

TABLE 68.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY SPECIFIED INDUSTRIES—PER CENT DISTRI- WAGE-EARNERS AND OF EACH CLASS, NUMBER OF ESTABLISHMENTS, AND PER CENT NUMBER OF ALL

	INDUSTRY.	Number of establishments.	Per cent number all wage-earners included in statistics of weekly earnings forms of greatest number, all establishments.	AVERAGE WEEKLY EARNINGS.				MEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).				
				All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.
147	Hardware	237	45.1	$9.61	$10.37	$5.35	$4.02	1.1	2.5	4.0	4.8	7.8
148	Hardware, saddlery	46	27.6	10.03	10.54	5.64	3.76	0.3	3.3	6.0	5.2	6.1
149	Hat and cap materials	33	34.3	7.65	8.70	5.02	3.84	0.7	0.6	3.9	6.7	20.8
150	Hats and caps, other than felt, straw, and wool	197	40.3	10.54	12.71	6.91	3.37	0.4	0.5	2.0	6.7	4.0
151	Hats, felt	118	47.3	11.27	13.27	7.31	3.33	0.6	1.8	3.1	3.5	4.3
152	Hats, straw	28	54.1	8.63	11.37	7.47	2.51	0.9	1.1	4.6	3.8	5.4
153	Hats, wool	7	42.7	9.29	10.93	5.43	3.69	4.5	2.8	7.1	4.5	5.9
154	Hones and whetstones	9	22.8	7.67	7.93	2.67		1.7	6.9	8.6	6.9	5.2
155	Horseshoes	3	45.8	11.57	11.65		5.50			0.6	7.7	16.1
156	Hosiery and knit goods	416	38.8	6.48	8.90	6.01	3.19	2.8	3.6	5.9	6.8	12.5
157	Housefurnishing goods, not elsewhere specified	125	39.9	8.38	9.86	7.11	3.89	0.7	2.0	4.7	6.2	8.1
158	Ice, manufactured	829	48.8	10.82	10.87	4.09	2.30	2.7	1.8	2.3	3.4	7.1
159	Ink, printing	45	59.8	11.97	12.10	6.60	4.00	0.2	1.1	3.4	2.5	1.8
160	Ink, writing	24	84.4	7.38	9.83	5.45	3.83		6.0	9.0	5.0	4.5
161	Instruments, professional and scientific	134	47.6	10.57	11.27	5.82	3.43	0.9	3.6	5.5	5.3	7.0
162	Iron and steel, blast furnaces	82	50.3	11.70	11.71	5.00	5.33	1.5	0.7	1.1	1.1	2.3
163	Iron and steel, bolts, nuts, washers, and rivets, not made in rolling mills or steel works.	52	51.4	9.99	10.90	5.76	3.63	1.0	1.2	2.3	4.8	10.8
164	Iron and steel doors and shutters	15	48.8	13.04	13.04			0.5		0.2	2.4	5.7
165	Iron and steel forgings	78	56.4	12.88	12.91		4.54	1.2	0.9	1.5	2.4	3.5
166	Iron and steel, nails and spikes, cut and wrought, including wire nails, not made in rolling mills or steel works.	54	66.4	9.72	10.90	6.01	4.47	3.1	2.0	2.9	3.5	5.3
167	Iron and steel pipe, wrought	12	41.1	9.93	9.97	4.35		4.5	2.2	2.1	2.3	4.9
168	Iron and steel, steel works and rolling mills	192	46.5	12.45	12.56	5.95	4.58	1.1	1.2	1.4	2.1	3.8
169	Ivory and bone work	39	63.2	8.76	9.83	5.45	5.59	0.5	2.9	3.6	3.7	6.3
170	Japanning	24	87.6	9.12	11.07	5.10	5.00	0.3	4.7	5.3	6.3	8.2
171	Jewelry	657	59.8	11.69	13.87	6.91	3.52	1.2	2.5	3.8	4.0	4.6
172	Jewelry and instrument cases	55	41.0	7.64	10.69	5.04	4.09	1.1	4.3	4.3	8.0	5.1
173	Jute and jute goods	7	71.0	6.46	8.08	5.69	3.49	0.1	4.5	6.3	16.2	13.2
174	Kaolin and ground earths	76	45.7	8.99	9.12	4.69		2.1	1.2	0.9	1.2	18.0
175	Labels and tags	36	62.1	8.43	10.75	4.88	3.21	3.5	7.1	4.8	8.7	6.0
176	Lamps and reflectors	73	53.5	10.34	11.46	5.97	4.53	1.1	1.6	2.8	3.3	3.4
177	Lapidary work	34	34.5	20.45	21.68	8.18	4.50	0.5	1.1	2.1	2.7	2.7
178	Lard, refined	6	70.5	10.09	10.57	5.50	3.92	0.9	0.3	5.9	1.8	2.8
179	Lasts	42	67.2	14.97	15.01	7.00	3.67	0.7	0.5	1.8	3.5	4.6
180	Lead, bar, pipe, and sheet	25	71.3	12.66	12.66				0.5	1.1	0.5	2.3
181	Leather goods	212	28.2	8.76	10.90	5.75	2.71	1.0	3.8	6.0	6.1	8.9
182	Leather, tanned, curried, and finished	621	58.8	9.67	9.90	5.68	4.08	1.4	1.2	2.7	3.5	6.8
183	Lime	284	30.2	8.91	8.94	6.00	2.71	3.0	1.3	1.9	2.0	10.3
184	Linen goods	8	41.8	6.93	9.74	5.51	4.05	0.5	1.7	3.2	6.3	8.7
185	Liquors distilled	575	68.0	9.82	10.07	4.86	4.10	2.5	2.6	5.0	3.4	10.8
186	Liquors, malt	918	51.9	14.13	14.37	5.50	3.75	0.9	0.8	1.2	1.6	1.9
187	Liquors, vinous	255	41.1	10.10	10.31	6.56	4.29	1.0	1.3	0.8	1.0	2.3
188	Lithographing and engraving	120	50.8	13.25	15.05	5.56	3.74	2.0	4.2	6.5	4.7	4.3
189	Locomotives	11	94.1	12.44	12.46		3.65	1.8	1.6	2.0	2.3	3.1
190	Looking-glass and picture frames	298	56.4	9.83	10.42	5.95	3.79	1.4	2.8	6.0	5.5	6.6
191	Lumber and timber products	8,394	27.6	9.21	9.25	5.22	3.59	4.6	2.9	4.8	4.4	10.9
192	Lumber, planing mill products, including sash, doors, and blinds	2,866	41.8	11.05	11.15	5.18	3.65	1.8	2.1	3.7	4.0	7.1
193	Malt	85	51.9	14.06	14.06			0.4	0.1	0.4	0.1	0.5
194	Mantels, slate, marble, and marbleized	4	100.0	13.82	13.82							3.1
195	Marble and stone work	626	52.3	13.17	13.21	4.94	4.36	2.4	1.2	1.7	2.3	3.9
196	Matches	7	35.8	7.23	8.52	5.53	2.73	0.4	1.7	4.1	5.7	9.7
197	Mats and matting	3	34.6	7.36	7.36			5.0	1.4	20.6	14.5	11.3
198	Mattresses and spring beds	420	38.6	9.23	10.14	6.27	3.40	2.1	3.0	4.1	5.0	7.8
199	Millinery and lace goods	344	35.8	7.98	12.45	7.25	3.35	1.7	1.6	2.9	3.5	5.2
200	Mineral and soda waters	2,542	65.2	9.54	9.86	5.09	3.18	1.4	3.4	4.6	5.2	9.1
201	Mirrors	61	37.4	11.52	11.75	4.85	3.27	0.2	2.3	2.9	4.3	4.8
202	Models and patterns, not including paper patterns	362	55.8	13.94	14.43	7.65	4.39	1.2	3.5	3.7	3.6	3.8
203	Monuments and tombstones	1,009	49.1	13.74	13.76	8.50	2.44	0.8	1.3	1.5	2.8	3.8
204	Mucilage and paste	76	68.4	9.46	10.68	5.39	3.69	0.7	1.0	9.0	1.6	3.5
205	Musical instruments and materials, not specified	99	67.3	11.70	12.30	6.69	3.82	0.5	1.0	2.4	3.1	3.9
206	Musical instruments, organs	57	54.6	11.78	11.96	6.65	2.80	1.9	3.0	3.2	4.4	6.5
207	Musical instruments, pianos	125	47.0	12.51	12.83	5.79	3.77	0.8	1.5	2.7	3.7	3.9
208	Musical instruments, piano and organ materials	62	54.5	11.52	12.25	6.15	3.74	0.6	1.2	3.2	4.4	5.6
209	Needles, pins, and hooks and eyes	21	11.2	8.18	11.01	5.93	3.41	2.8	1.7	4.9	5.2	4.2
210	Nets and seines	5	75.4	5.90	13.21	5.34	3.40			3.5		
211	Oakum	3	76.8	6.86	7.54	2.78		6.5	7.4	1.9	2.8	18.5
212	Oil, cottonseed and cake	287	37.6	6.64	6.64	2.50	2.00	10.3	7.3	11.8	9.2	17.0
213	Oil, essential	27	57.4	10.57	10.57					1.9		7.7
214	Oil, linseed	17	63.0	11.99	11.99			1.8	0.6	0.3	0.2	0.5
215	Oil, not elsewhere specified	115	44.8	11.77	11.89	8.67	3.00	0.9	0.6	1.3	1.9	3.3
216	Oilcloth and linoleum, floor	11	59.6	10.17	10.53	5.17	4.53	0.1	0.3	0.4	1.7	2.3
217	Oilcloth, enameled	6	45.1	10.40	10.49	5.86				3.3	5.6	4.4
218	Oleomargarine	7	34.9	12.49	12.73	6.71	4.00			1.4	1.9	1.9
219	Optical goods	89	71.7	9.06	10.58	5.84	3.33	1.0	1.7	4.0	3.3	9.3
220	Ordnance and ordnance stores	3	98.4	12.53	12.53			1.6	1.9	3.2	1.9	3.5
221	Paints	304	56.3	10.24	10.71	5.69	3.83	3.4	2.0	2.2	2.8	3.8

BUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—WITH AVERAGE WEEKLY EARNINGS OF ALL WAGE-EARNERS IN THE STATISTICS FORMS OF GREATEST NUMBER, ALL ESTABLISHMENTS: 1905—Continued.

MEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS)—continued.								WOMEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).											CHILDREN UNDER 16 YEARS (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).							
$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 to $20.	$20 to $25.	$25 and over	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
9.7	8.9	12.1	16.6	18.2	11.9	1.9	0.5	4.7	20.3	22.7	17.7	14.8	9.6	5.0	3.1	1.4	0.6	0.1	12.2	38.2	28.1	13.8	6.1	1.2	0.4	147
7.8	8.9	11.3	18.1	15.2	14.0	2.8	1.0		17.4	31.4	12.8	15.1	7.0	4.7	2.3	8.1	1.2		23.5	35.3	29.4		11.8			148
16.3	16.1	9.6	12.2	8.1	3.8	1.2		8.4	31.7	11.9	14.1	22.9	4.4	3.1	0.4	1.8	1.3		25.0	40.6	28.2	3.1	3.1			149
3.3	4.9	5.5	14.8	23.5	25.8	5.8	2.8	3.9	9.1	11.4	16.8	17.1	14.5	9.6	6.8	4.7	3.9	2.2	30.0	36.7	20.0	13.3				150
6.0	5.4	8.6	12.0	19.0	21.1	9.7	4.9	2.5	6.3	10.0	13.8	12.8	13.2	15.8	12.0	8.3	4.0	1.3	29.8	43.1	17.6	8.7	0.8			151
7.2	7.4	14.1	16.3	21.2	10.6	5.0	2.4	5.7	6.1	8.9	13.4	11.2	11.6	11.4	9.9	12.0	7.1	2.7	81.6	18.4						152
7.5	15.0	13.4	7.9	11.3	9.0	8.4	2.7	21.8	11.1	16.3	13.7	15.2	5.6	2.5	6.7	2.6	3.0	1.5	30.8	15.4	15.4	30.8		7.6		153
10.3		48.3	5.2	5.2	1.7			100.0																		154
13.6	5.2	8.4	11.6	13.6	14.8	5.2	3.2															50.0	50.0			155
13.9	12.3	11.1	13.3	9.3	5.8	1.8	0.9	7.3	10.2	15.0	16.2	17.3	14.1	8.7	6.1	3.6	1.3	0.2	43.0	34.4	13.3	5.9	2.5	0.8	0.1	156
10.1	11.4	17.2	14.3	14.1	8.4	1.9	0.9	2.8	3.2	10.6	13.5	10.2	14.7	29.9	11.1	2.9	1.0	0.1	4.2	49.3	25.3	11.3	9.9			157
7.3	7.4	9.7	19.3	23.5	11.0	3.1	1.4	36.4	18.2		18.2	18.2				9.0			70.0	20.0	10.0					158
3.8	3.2	9.7	19.9	34.1	14.7	3.6	2.0				40.0	20.0	20.0			20.0					100.0					159
7.5	8.0	11.0	14.5	20.5	10.5	1.0	2.5	12.6	14.3	22.9	19.0	11.3	10.4	4.3	1.7	2.2	0.9	0.4		75.0	25.0					160
6.0	6.5	6.7	11.6	19.3	20.8	4.8	2.0	1 2	16.9	22.8	20.5	14.0	6.4	5.3	5.3	4.1	2.9	0.6	50.0	26.1	19.6	4.3				161
5.0	4.9	10.7	31.0	26.8	11.6	2.6	0.7				100.0								2.4	11.9	14.3	69.0			2.4	162
6.9	6.9	17.1	13.9	15.8	16.2	2.8	0.3	0.9	1.8	16.1	25.8	45.7	5.1	1.1	0.8	1.1	1.1	0.5	9.7	50.7	36.8	2.8				163
7.3	4.0	8.1	13.1	15.0	26.1	15.7	1.9																			164
5.6	5.6	13.1	18.0	20.5	16.8	6.7	4.2													30.7	38.5	15.4	15.4			165
12.5	11.6	9.4	14.0	12.9	18.0	3.1	1.7	3.1	9.0	12.2	21.9	35.3	6.7	5.9	2.8	2.3	0.6	0.2	12.8	12.8	23.4	29.8	21.2			166
9.6	14.7	19.0	18.4	11.4	7.1	2.3	1.5	60.0		15.0		20.0	5.0													167
7.9	12.5	13.3	17.9	15.9	12.7	4.6	5.6	8.3	7.3	19.8	19.1	17.3	14.4	7.4	2.9	2.6	0.8	0.1	14.4	19.9	28.5	16.1	14.5	4.8	1.8	168
10.7	11.4	11.7	20.1	20.4	7.2	1.1	0.4	4.7	8.3	18.8	27.9	19.9	9.8	7.3	1.8	1.1	0.4		3.3	14.7	24.6	36.1	11.5	9.8		169
5.7	6.0	12.2	19.4	14.1	10.0	5.0	2.8	24.6	10.3	19.2	20.6	9.6	4.1	4.1	3.4	4.1					62.5	25.0		12.5		170
5.2	5.5	5.4	11.4	18.3	20.6	9.8	7.7	4.0	5.5	12.0	17.4	16.2	13.3	11.6	7.2	6.7	4.6	1.5	35.1	34.5	19.5	7.8	2.3	0.5	0.3	171
6.8	6.2	9.9	9.1	23.3	18.2	2.6	1.1	13.8	20.1	24.8	12.0	10.5	6.5	6.5	1.5	2.0	1.8	0.5	9.0	36.4	36.4	18.2				172
18.5	8.1	7.2	12.0	7.5	5.4	0.8	0.2	4.0	11.9	19.2	23.3	18.3	9.7	3.2	1.5	1.6	1.6	0.7	32.6	57.3	5.5	4.6				173
10.1	8.9	26.0	15.3	9.8	5.7	0.6	0.2		38.4	43.6	7.7		7.7	2.6												174
8.5	5.5	6.2	13.7	14.8	12.7	6.3	2.2	1.4	27.9	27.3	19.5	11.5	9.5	1.4	0.6	0.6		0.3	37.9	37.9	24.2					175
7.6	8.6	10.1	18.7	18.7	19.4	3.5	1.2	0.9	3.7	13.1	25.8	30.3	18.1	5.5	0.4	2.0	0.2		7.0	27.9	27.9	25.6	9.3	2.3		176
2.7	0.5	3.2	3.2	9.1	16.1	15.5	40.6		9.1	9.1		27.2		18.2	9.1		18.2	9.1		66.7			16.7	16.6		177
15.2	2.2	26.3	24.8	10.5	9.0	0.3				88.8	5.6							5.6		100.0						178
4.3	2.7	7.6	9.5	21.6	24.1	12.6	6.5						100.0							33.3	66.7					179
1.6	3.1	10.1	24.5	28.1	23.1	4.0	1.1																			180
7.1	6.9	9.7	13.8	15.9	15.0	3.4	2.4	4.5	17.0	15.3	20.0	18.5	8.8	5.2	3.6	4.7	1.9	0.5	54.8	32.2	10.2	1.7			1.1	181
10.0	11.8	17.9	21.7	14.4	6.9	1.2	0.5	3.2	5.8	9.1	35.0	37.2	7.9	1.1	0.1	0.2	0.2	0.2	13.8	22.6	36.7	20.4	6.5			182
14.0	6.9	31.1	18.3	7.8	2.9	0.4	0.1				50.0		50.0						41.2	47.0	5.9			5.9		183
14.2	9.3	18.8	16.6	13.3	5.4	1.4	0.6	2.0	3.9	16.3	28.3	33.1	8.2	7.1	0.8	0.2	0.1		13.0	18.2	31.8	26.1	8.3	2.1	0.5	184
7.7	3.6	16.2	16.8	18.0	10.0	2.1	1.3	3.7	9.4	49.6	15.2	9.9	4.9	4.1	1.2	0.8	0.8	0.4	10.0	10.0	80.0					185
3.2	1.7	4.3	9.2	23.7	41.9	7.8	1.8	1.0	12.9	9.5	45.5	14.3	10.2	4.5	2.1				22.1	34.7	24.6	7.0	9.5	2.1		186
6.4	5.4	19.3	39.0	18.3	4.6	0.4	0.2	4.7	21.2	17.7	8.2	8.2	8.2	8.2	7.1	5.9	10.6			23.5	70.6		5.9			187
4.2	4.3	5.1	8.5	11.4	15.2	15.7	13.9	4.2	17.9	24.4	15.9	15.0	9.4	3.9	3.5	4.4	1.1	0.3	7.6	57.1	21.0	4.8	7.6	1.9		188
6.2	9.3	11.7	15.4	20.5	16.4	4.9	4.8												19.0	50.8	14.3	14.3		1.6		189
9.3	6.3	11.8	14.9	18.5	12.8	3.1	1.0	2.4	15.9	30.7	17.5	9.5	7.7	3.7	1.8	5.8	2.6	2.4	12.5	36.9	39.9	5.9	2.4	1.8	0.6	190
11.3	7.3	19.0	12.8	12.1	7.0	1.9	1.0	16.2	18.9	13.2	14.2	16.6	9.3	1.0	4.3	1.7	3.6	1.0	33.0	32.4	21.1	5.1	5.0	2.0	1.4	191
7.1	5.8	13.7	12.1	18.5	18.9	4.6	0.6	12.4	12.0	24.4	10.7	28.9	5.4	2.9	1.2	1.7	0.4		23.0	33.1	29.1	10.9	2.7	0.8	0.4	192
0.3	0.5	5.8	8.0	39.5	40.2	3.6	0.6																			193
4.2		17.7	7.3	27.1	27.1	13.5																				194
5.2	7.0	12.2	13.7	13.5	20.9	11.3	4.7	18.6	20.0	14.3	15.7	15.7	8.6	1.4	1.4	2.9	1.4		18.0	16.0	26.0	26.0	4.0	8.0	2.0	195
25.8	14.6	15.1	10.7	7.9	3.2	0.7	0.4	5.2	13.7	20.1	24.1	17.7	9.8	5.8	3.0	0.6			53.9	26.9	19.2					196
6.7	3.9	12.1	16.3	6.0	1.8		0.4																			197
7.5	9.0	14.5	16.1	16.3	10.8	3.2	0.6	4.0	7.4	12.2	18.9	18.5	11.4	8.5	8.7	7.3	2.6	0.5	24.7	45.3	22.7	3.1	2.1	2.1		198
6.0	7.0	8.4	16.8	18.0	14.7	8.9	5.3	7.2	8.0	10.2	11.5	15.7	11.5	9.3	7.3	8.1	6.9	4.3	43.3	25.9	18.4	8.1	4.3			199
7.0	6.2	12.8	17.8	19.4	10.9	1.6	0.6	8.5	17.0	24.8	13.9	18.6	7.0	7.0		0.8	1.6	0.8	34.0	35.2	21.7	4.7	3.3	1.1		200
6.3	4.1	10.4	12.6	23.2	26.2	2.0	0.7		22.2	22.2	40.8	7.4	3.7		3.7				18.2	54.5	18.2	9.1				201
4.2	2.0	4.8	7.2	11.5	34.0	19.4	1.1	4.5	1.8	12.6	9.9	19.0	13.5	9.0	10.8	10.8	6.3	1.8	16.1	22.6	22.6	25.8	9.7		3.2	202
3.8	2.2	7.2	9.2	17.0	41.8	6.6	2.0				50.0	16.6				16.7		16.7	44.4	44.4	11.2					203
8.7	3.5	14.9	17.4	25.2	11.9	1.6	1.0	2.9	17.1	15.7	14.3	32.9	7.1	8.6		1.4			18.8	12.5	56.2	12.5				204
5.5	4.1	9.7	15.7	25.5	22.3	4.3	2.0	1.1	4.3	9.7	23.7	32.2	10.7	5.4	5.4	5.4	2.1		16.1	42.0	24.2	16.1		1.6		205
5.2	5.4	9.6	14.4	19.3	18.9	6.5	1.7	4.4	16.2	16.2	30.8	5.9	5.9			10.3	10.3		60.0		40.0					206
4.6	5.9	8.3	13.5	22.8	23.1	5.7	3.5	1.0	4.5	20.2	28.1	17.4	16.7	6.6	2.1	2.4	1.0		13.1	46.9	20.0	16.6	3.4			207
6.0	7.4	9.7	15.5	20.3	16.1	6.9	3.1	1.6	14.8	27.2	30.8	17.7	5.2	1.0	0.7	0.7	0.3		5.5	64.4	22.4	2.7	0.9	2.3	1.8	208
7.6	6.9	11.8	20.5	13.5	17.7	2.8	0.4	4.3	7.7	15.9	23.6	21.2	13.2	6.1	2.8	4.3	0.6	0.3	11.8	88.2						209
1.7	1.8	5.3	26.3	26.3	26.3	5.3	3.5	5.7	13.9	19.4	25.0	20.9	9.9	3.3	1.1	0.6	0.2		12.0	88.0						210
29.6	5.6	15.7	6.5	0.9	3.7	0.9		50.0	44.4	5.6																211
17.1	4.8	10.9	5.3	4.3	1.6	0.3	0.1	83.3				16.7							100.0							212
7.1	9.6	25.0	23.8	14.7	7.7	1.9	0.6																			213
4.3	1.7	8.2	38.9	33.4	8.6	1.1	0.4																			214
4.1	2.7	14.0	21.6	30.6	16.1	2.1	0.8			12.5	4.1	16.7	33.3	16.7	4.2		4.2	8.3		100.0						215
10.8	14.7	25.8	15.2	14.1	12.5	1.8	0.3		8.3	20.8	64.6	4.2		2.1					1.1	30.7	27.3	18.2	22.7			216
10.6	11.8	17.4	16.8	20.9	8.3	0.9				42.8	28.6	14.3		14.3												217
1.0	2.4	10.6	21.2	26.9	24.5	4.3	3.9				14.3	28.6	57.1								100.0					218
10.0	8.6	11.2	14.1	20.2	12.5	3.1	1.0	2.4	4.0	20.9	22.9	26.5	12.4	6.6	2.4	1.1	0.8		11.4	79.9	5.4	2.7	0.6			219
0.7	6.1	8.3	11.2	34.0	23.4	3.5	0.7																			220
5.9	8.5	15.2	23.2	18.5	10.9	2.6	1.0	4.2	19.3	16.1	18.3	13.4	12.7	7.2	2.0	5.0	1.0	0.8		83.4		8.3	8.3			221

TABLE 68.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY SPECIFIED INDUSTRIES—PER CENT DISTRI- WAGE-EARNERS AND OF EACH CLASS, NUMBER OF ESTABLISHMENTS, AND PER CENT NUMBER OF ALL

	INDUSTRY.	Number of establishments.	Per cent number all wage-earners included in statistics of weekly earnings forms of greatest number, all establishments.	AVERAGE WEEKLY EARNINGS.				MEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).				
				All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.
222	Paper and wood pulp	381	50.6	$9.81	$10.64	$5.85	$4.86	2.1	1.2	1.6	1.8	3.7
223	Paper goods, not elsewhere specified	130	64.6	8.00	11.22	5.43	3.95	1.7	2.2	3.7	4.2	5.7
224	Paper patterns	9	67.7	7.92	15.14	6.52	3.71	......	1.3	3.3	5.9	7.2
225	Patent medicines and compounds	1,154	53.4	7.84	10.52	5.53	3.60	1.5	2.5	4.5	5.7	7.9
226	Paving materials	24	39.0	9.91	9.91	......	......	7.9	3.4	3.4	3.0	5.0
227	Peanuts, grading, roasting, cleaning, and shelling	9	22.7	2.97	7.12	2.26	......	......	......	1.5	11.9	56.7
228	Pencils, lead	3	38.0	7.23	10.61	5.04	3.58	2.1	8.7	6.6	5.2	5.6
229	Pens, fountain and stylographic	13	44.5	8.03	8.56	5.15	3.50	1.1	13.1	14.6	6.7	9.7
230	Pens, gold	6	22.2	15.91	16.05	10.50	......	......	5.5	4.1	5.5	4.1
231	Perfumery and cosmetics	174	51.1	6.93	10.64	5.30	2.75	0.5	4.6	7.5	8.0	7.3
232	Petroleum, refining	58	77.9	12.07	12.31	5.70	3.96	2.0	1.3	1.9	1.7	3.3
233	Phonographs and graphophones	8	48.1	10.54	11.09	6.09	3.43	5.4	2.7	2.9	3.3	3.7
234	Photographic apparatus	29	88.2	9.47	10.20	6.25	4.37	1.1	2.5	3.3	4.1	5.9
235	Photographic materials	53	73.5	8.62	11.67	5.27	3.66	0.8	1.7	3.9	4.7	4.0
236	Photolithographing and photoengraving	117	52.1	15.34	16.68	6.49	3.53	2.1	4.1	4.3	4.6	4.2
237	Pickles, preserves, and sauces	303	52.8	6.39	8.61	4.33	1.84	13.2	3.6	3.1	3.3	6.6
238	Pipes, tobacco	32	56.1	8.99	9.49	5.61	3.25	1.6	8.4	7.9	7.8	9.8
239	Plated ware	33	31.8	12.81	13.89	5.99	4.15	1.1	1.9	2.4	2.9	4.3
240	Plumbers' supplies	107	59.9	11.42	11.58	5.89	3.68	0.8	1.5	3.7	2.4	3.4
241	Pocketbooks	23	21.5	7.51	8.86	5.81	3.67	1.3	8.7	10.6	10.9	11.2
242	Pottery, terra cotta, and fire clay products	420	38.1	10.32	10.87	5.69	4.02	1.9	1.2	2.2	3.2	4.6
243	Printing and publishing, book and job	4,802	49.6	11.21	12.94	6.54	3.54	2.3	3.7	4.5	4.2	5.0
244	Printing and publishing, music	33	50.3	11.63	12.97	6.56	3.00	......	4.4	2.9	4.0	3.3
245	Printing and publishing, newspapers and periodicals	10,860	57.9	11.39	13.13	5.95	2.87	3.4	3.5	3.8	4.3	6.1
246	Printing materials	57	67.2	11.87	12.20	6.44	4.40	1.1	1.5	2.7	6.5	3.8
247	Pulp goods	10	61.5	9.01	9.76	4.57	3.00	......	3.5	3.8	2.6	6.4
248	Pumps, not including steam pumps	67	66.4	10.22	10.29	4.75	3.50	2.7	1.8	2.4	4.0	8.1
249	Refrigerators	59	24.1	11.65	11.69	8.00	3.60	0.7	4.4	3.0	3.6	3.5
250	Regalia and society banners and emblems	79	47.3	8.39	12.07	6.73	3.05	0.9	2.6	5.0	5.7	5.2
251	Rice, cleaning and polishing	8	8.8	7.21	7.21	......	......	17.8	11.2	5.8	2.5	12.9
252	Roofing materials	141	28.2	11.23	11.37	2.00	4.24	1.0	0.7	1.3	1.6	4.0
253	Rubber and elastic goods	133	65.7	9.80	11.25	6.99	4.49	0.8	0.9	2.4	3.5	4.5
254	Rules, ivory and wood	7	73.8	6.81	9.77	3.46	2.25	1.5	1.5	6.2	4.6	1.5
255	Saddlery and harness	760	46.2	10.46	11.13	5.09	2.90	1.4	3.0	2.7	3.9	5.2
256	Safes and vaults	18	57.8	12.25	12.30	......	4.62	1.3	1.9	2.2	2.3	3.1
257	Salt	57	31.6	9.04	9.29	4.67	......	5.4	2.9	3.2	2.8	4.5
258	Sausage	198	55.5	11.36	11.48	6.00	3.50	1.4	1.0	2.7	3.1	2.3
259	Saws	48	28.6	11.98	12.32	6.00	5.30	3.5	3.4	3.2	3.4	6.4
260	Scales and balances	52	64.6	11.91	11.97	11.07	4.18	0.6	0.5	1.6	2.6	4.4
261	Screws, machine	20	86.5	9.68	10.16	5.02	4.13	0.7	1.6	7.7	5.8	7.3
262	Screws, wood	5	86.3	8.00	10.10	5.25	3.61	0.9	3.4	3.5	2.2	2.6
263	Sewing machine cases	3	49.6	9.65	10.21	6.12	4.53	......	1.6	1.7	2.3	4.4
264	Sewing machines and attachments	27	43.9	12.46	12.59	7.43	3.10	0.3	0.6	1.1	2.3	3.8
265	Shipbuilding, iron and steel	28	46.7	11.19	11.32	8.00	3.38	2.1	2.1	3.6	4.7	4.9
266	Shipbuilding, wooden, including boat building	518	37.0	12.44	12.45	7.25	3.70	3.9	2.4	2.1	3.0	3.1
267	Shirts	242	38.8	6.33	10.20	5.69	2.31	1.4	4.9	6.0	7.4	9.8
268	Shoddy	59	55.4	8.00	8.86	4.86	2.25	1.0	1.0	2.4	5.1	9.0
269	Show cases	83	52.2	11.07	11.14	6.54	3.80	0.7	1.9	3.4	3.4	3.8
270	Silk and silk goods	205	33.6	7.28	10.57	6.11	3.13	2.2	4.0	5.7	5.5	5.7
271	Silversmithing and silverware	53	58.1	12.18	13.13	6.12	3.47	0.5	2.8	4.0	2.9	3.8
272	Slaughtering and meat packing, wholesale	348	38.3	10.65	10.98	6.49	4.60	1.9	1.2	1.6	2.3	3.8
273	Slaughtering, wholesale, not including meat packing	269	53.4	14.08	14.12	8.22	5.88	0.9	0.5	0.6	1.1	1.6
274	Smelting and refining, copper	18	45.4	15.55	15.60	......	7.09	1.1	0.8	0.5	1.2	1.9
275	Smelting and refining, lead	12	43.0	12.34	12.34	10.30	......	1.5	0.7	1.0	0.9	5.4
276	Smelting and refining, zinc	14	37.2	11.15	11.19	......	4.82	4.4	2.8	3.0	2.5	4.0
277	Smelting and refining, not from the ore	39	54.6	12.25	12.29	4.33	......	0.8	0.9	0.9	0.9	1.5
278	Soap	275	49.0	8.42	10.11	4.89	3.81	2.8	2.2	3.8	5.1	6.5
279	Soda water apparatus	18	45.6	11.94	12.99	4.69	3.33	1.5	0.9	2.8	3.0	3.0
280	Sporting goods	88	40.0	8.21	10.13	5.76	3.52	0.8	3.0	4.0	5.8	7.3
281	Springs, steel, car and carriage	27	51.9	10.78	10.84	......	3.38	4.7	2.1	2.5	4.3	5.8
282	Stamped ware	86	51.0	8.86	9.85	5.66	3.72	2.5	4.7	5.2	6.2	6.9
283	Starch	73	37.7	10.75	11.35	5.57	4.25	1.7	1.7	2.5	1.6	5.5
284	Stationery goods, not elsewhere specified	82	56.0	7.42	9.62	5.18	3.01	3.1	4.9	6.7	5.9	8.7
285	Statuary and art goods	82	47.1	15.91	16.45	5.95	3.67	0.3	0.5	3.0	2.1	3.1
286	Steam fittings and heating apparatus	124	73.4	11.59	11.64	5.35	4.25	0.9	1.5	2.0	1.9	3.9
287	Steam packing	61	48.4	9.91	10.30	5.32	......	2.8	1.4	1.5	4.1	7.5
288	Stencils and brands	74	70.1	11.14	11.82	7.60	3.38	1.1	3.7	2.6	5.0	5.5
289	Stereotyping and electrotyping	85	52.6	14.56	14.85	7.53	3.63	1.1	3.8	3.6	7.0	5.8
290	Stoves and furnaces, not including gas and oil stoves	206	50.6	12.88	13.02	8.17	3.79	1.7	1.7	2.3	3.0	3.4
291	Stoves, gas and oil	46	52.6	10.75	10.80	5.79	3.71	0.9	1.2	4.7	3.4	4.8
292	Straw goods, not elsewhere specified	4	51.1	8.53	10.91	7.02	......	......	......	......	......	......
293	Structural ironwork	418	47.2	11.52	11.53	6.75	5.27	1.0	0.9	1.5	2.2	3.8
294	Sugar and molasses, refining	60	26.8	11.51	11.81	5.11	4.20	1.3	0.8	1.2	1.5	1.6
295	Sulphuric, nitric, and mixed acids	17	57.9	11.65	11.66	......	5.00	3.1	1.9	1.1	2.1	3.1
296	Surgical appliances	94	24.0	9.55	12.14	6.17	3.90	0.7	2.1	5.1	4.7	5.6

BUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—WITH AVERAGE WEEKLY EARNINGS OF ALL WAGE-EARNERS IN THE STATISTICS FORMS OF GREATEST NUMBER, ALL ESTABLISHMENTS: 1905—Continued.

MEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS)—continued.								WOMEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).											CHILDREN UNDER 16 YEARS (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).							
$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 to $20.	$20 to $25.	$25 and over	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
7.0	9.5	24.6	19.9	15.5	9.8	2.5	0.8	2.5	5.4	17.9	17.4	38.0	11.3	4.6	2.0	0.4	0.3	0.2	11.5	12.6	28.0	17.0	26.4	1.7	2.8	222
7.5	6.5	13.6	16.7	17.7	15.0	4.0	1.5	6.8	16.3	21.6	17.9	15.9	9.5	5.9	2.9	2.3	0.6	0.3	18.2	31.8	35.7	7.8	2.6	3.9		223
5.2	4.6	7.8	11.8	9.1	11.8	11.8	20.2	14.0	11.3	18.2	14.7	14.1	8.1	5.9	2.3	3.3	2.9	5.2		85.7	14.3					224
8.3	6.6	12.8	16.7	15.0	12.9	3.1	2.5	6.0	15.9	17.2	19.9	15.9	11.1	4.2	3.7	4.1	1.4	0.6	36.1	28.7	19.2	4.1	3.7	3.7	4.5	225
5.5	11.1	14.0	20.4	13.1	8.5	3.3	1.4																			226
7.5	3.0	8.9	4.5	3.0	1.5	1.5		88.0	8.2	3.6				0.2												227
6.8	3.1	4.9	14.0	20.4	16.9	4.3	1.4	9.1	26.1	15.6	12.1	17.9	10.8	3.6	2.6	1.8	0.4		6.1	78.8	15.1					228
7.9	3.0	8.3	8.3	13.1	10.1	3.0	1.1	8.7	15.2	32.7	8.7	15.2	10.9	4.3			4.3			50.0	50.0					229
1.4	2.7		5.5	16.4	12.3	31.5	11.0								50.0		50.0									230
8.5	8.8	6.1	13.6	15.1	12.2	3.9	3.9	3.1	18.1	23.5	21.0	16.2	9.2	3.5	1.9	2.0	1.0	0.5	53.6	32.1	10.7		3.6			231
3.2	3.6	20.1	15.6	18.8	21.8	5.4	1.3	9.1	9.1	9.1	21.2	24.2	15.2	9.1	3.0				2.0	18.7	53.5	18.2	6.9	0.7		232
5.9	7.4	10.2	16.3	20.8	18.1	2.7	0.6	4.2	3.3	16.5	29.7	16.5	17.0	5.2	4.2	2.4	0.5	0.5		100.0						233
7.1	8.0	9.5	19.1	30.1	7.6	1.4	0.3	5.7	4.2	15.2	17.0	15.9	20.8	13.3	6.4	1.5			2.3	60.5	23.3	7.0	2.3	2.3	2.3	234
4.8	6.0	9.1	20.3	24.3	14.2	4.4	1.8	12.3	8.3	26.6	24.3	13.9	7.8	3.4	1.6	1.2	0.5	0.1	9.7	31.7	41.5	17.1				235
3.4	2.3	2.9	6.9	10.3	17.7	16.4	20.8	2.4	18.0	26.8	10.8	10.4	7.2	7.2	4.0	5.2	3.2	4.8	12.3	53.1	26.6	2.0	2.0	2.0	2.0	236
8.6	10.5	15.7	14.5	12.8	6.2	1.5	0.4	22.4	14.8	27.8	16.3	10.1	4.4	2.6	0.8	0.7	0.1		63.8	23.8	8.6	2.9	0.9			237
8.8	8.1	6.4	13.5	13.1	11.6	2.1	0.9		23.4	18.7	25.0	14.1	7.8	0.8	4.7	3.1	1.6	0.8	30.0	40.0	20.0	10.0				238
3.4	5.6	4.8	12.1	18.7	32.6	8.7	1.5	5.9	10.5	14.8	19.1	26.6	7.8	4.3	3.9	5.9	0.4	0.8	8.5	29.8	34.1	25.5	2.1			239
5.4	4.5	16.7	16.9	19.3	18.8	5.2	1.4	6.3	2.3	8.6	33.3	11.5	13.2	13.8	5.2	5.2		0.6	20.6	32.3	41.2	5.9				240
11.8	7.2	6.5	11.8	5.3	8.1	4.4	2.2	0.8	10.6	20.8	26.4	16.2	14.5	6.8	2.1	0.9	0.9			100.0						241
8.5	10.5	21.4	17.2	13.6	9.7	3.5	2.5	5.6	15.7	23.3	20.9	11.4	9.8	4.0	2.6	2.3	3.6	0.8	15.5	27.3	23.7	20.6	11.6	1.1	0.2	242
5.0	4.9	6.1	9.5	15.3	25.1	9.7	4.7	7.2	10.9	13.4	15.1	15.4	12.6	8.3	4.6	5.9	3.8	2.8	24.0	41.8	20.7	8.0	3.0	1.4	1.1	243
5.5	3.3	4.4	13.9	25.9	25.5	4.4	2.5		12.7	9.9	7.0	26.7	9.9	9.9	19.7	4.2				100.0						244
4.9	4.8	6.8	12.0	15.0	16.5	9.2	9.7	8.5	14.5	15.1	17.8	15.7	8.0	6.3	4.0	4.5	2.9	2.7	49.0	27.3	12.5	6.8	3.0	0.7	0.7	245
4.9	5.3	9.5	14.8	20.2	17.1	8.4	4.2		22.2		22.2		11.1	44.5						20.0	60.0		20.0			246
13.5	7.3	19.7	9.5	24.3	7.9	1.3	0.2		46.4	19.6	10.7	17.9	5.4						20.0	80.0						247
13.1	10.3	13.9	15.0	13.2	11.0	3.5	1.0			75.0		25.0							37.5	37.5	12.5		12.5			248
5.0	7.5	9.3	15.2	25.3	17.1	4.3	1.1					50.0				50.0				80.0	20.0					249
7.9	6.5	8.5	13.3	20.7	14.6	3.9	5.2	2.3	9.2	14.8	12.6	17.2	17.7	12.4	7.4	4.1	1.9	0.4	45.0	45.0			10.0			250
7.9	1.7	17.8	9.9	7.9	1.7	2.5	0.4																			251
8.4	8.2	16.1	16.5	24.6	13.5	2.4	1.7	80.0	20.0										17.7	39.2	15.7	13.7	7.8	5.9		252
6.3	8.7	17.0	19.6	18.6	14.7	2.3	0.7	3.2	6.0	11.8	16.0	19.3	14.9	10.4	10.2	5.9	1.4	0.9	14.1	32.7	20.2	21.7	5.8	4.6	0.9	253
15.4	3.1	18.5	12.3	29.2	6.2			34.6	28.9	26.9	5.8	3.8							100.0							254
6.2	5.9	9.4	16.1	24.3	19.3	2.2	0.4	10.1	18.6	16.9	24.3	16.1	6.8	4.3	2.3	0.6			53.4	24.0	16.8	5.8				255
3.6	6.8	19.5	13.0	22.3	16.5	5.4	2.1												7.7	30.7	23.1	15.4	23.1			256
8.5	6.7	26.6	22.4	13.4	3.3	0.3		23.9	20.3	16.8	8.0	11.5	11.5	2.7	0.9	3.5	0.9									257
4.0	3.2	8.6	23.7	28.9	19.0	1.9	0.2	7.6		7.7	23.1	23.1	23.1	7.7	7.7				25.0	50.0	25.0					258
6.2	8.7	9.2	11.9	13.8	18.9	8.1	3.3				61.5		30.8			7.7			5.3	12.2	35.1	35.1	5.3	1.7	5.3	259
5.1	10.8	14.4	14.3	20.4	17.4	5.1	2.8				7.1		14.3			14.3	57.2	7.1	11.8	11.8	58.8	11.8	5.8			260
8.0	9.6	9.4	14.6	22.9	10.5	1.2	0.7		10.9	32.5	43.4	8.4	3.6			1.2			7.9	25.0	47.4	19.7				261
15.1	15.7	10.4	20.2	15.4	9.5	1.1		5.2	19.8	22.1	25.5	15.7	6.3	3.5	0.8	1.1			15.9	63.7	13.6	6.8				262
12.3	16.8	13.8	20.8	17.9	7.4	1.0				11.8	58.8	29.4							10.1	25.6	22.0	26.9	15.4			263
4.4	6.7	12.4	18.8	25.0	18.7	4.1	1.8		3.7	5.6	15.0	19.6	18.7	8.4	13.1	15.0	0.9		47.6	47.6	4.8					264
6.9	6.7	9.3	16.5	17.6	19.9	4.2	1.5		14.3	14.3	9.5	19.0				19.1	23.8		35.5	36.6	19.8	7.5		0.3	0.3	265
4.5	3.0	9.2	12.1	21.0	28.8	5.4	1.5		12.5			37.5	25.0			25.0			10.0	30.0	40.0	20.0				266
10.4	8.7	8.0	13.6	13.1	12.0	3.1	1.6	12.5	13.6	14.6	16.2	13.1	10.7	8.0	5.2	3.8	1.8	0.5	86.5	11.7	0.9	0.6	0.1	0.2		267
19.8	13.8	22.9	12.1	8.4	3.3	0.8	0.4	7.9	13.6	18.3	21.6	37.2	0.7		0.7				50.0	25.0		25.0				268
4.2	5.7	11.2	18.7	28.3	16.7	1.8	0.2				38.5	15.3	38.5			7.7			10.0	40.0	20.0	20.0	10.0			269
5.6	6.6	11.6	14.1	19.5	15.4	3.1	1.0	7.3	11.8	17.0	16.0	15.0	11.1	7.9	5.9	4.4	2.7	0.9	42.6	33.7	15.1	5.6	2.6	0.3	0.1	270
4.0	3.6	9.2	12.9	19.9	25.4	7.0	4.0	2.6	5.2	16.8	18.7	27.8	13.2	7.4	3.5	1.7	1.9	1.2	14.4	45.4	25.8	8.2	6.2			271
5.1	7.5	14.0	26.8	21.5	11.9	1.7	0.7	4.8	3.4	17.9	17.1	33.9	9.5	4.5	5.2	1.7	1.0	1.0	9.3	16.7	46.4	8.2	12.3	4.2	2.9	272
2.5	2.2	5.8	17.8	29.1	25.4	7.8	4.7		22.2			22.2	11.1		11.1	22.3		11.1		25.0	12.5	12.5	12.5	12.5	25.0	273
2.7	4.7	6.7	12.3	16.1	23.4	22.8	5.8												9.1	20.4	9.1	2.3	2.3	11.3	45.5	274
10.6	5.8	3.8	25.9	19.8	21.8	2.2	0.6								70.0	30.0										275
5.6	6.8	10.2	21.4	20.3	15.3	2.5	1.2													23.5	76.5					276
1.4	2.7	4.2	24.4	46.1	15.4	0.8		16.7		83.3									22.7	15.2	41.4	11.7	5.5	2.1	1.4	277
5.5	5.5	15.4	23.4	17.8	9.4	1.9	0.7	6.6	26.9	22.4	15.9	11.4	10.5	1.9	1.6	1.1	1.1	0.6		66.7	33.3					278
2.3	4.1	7.1	15.0	26.1	26.5	5.9	1.8	33.3	9.6	13.1	14.9	13.1	5.3	1.8	5.3	1.8	0.9	0.9	6.8	59.1	25.0	2.3	6.8			279
8.6	9.6	14.4	16.1	17.5	9.8	2.2	0.9	6.8	16.9	14.3	10.5	17.3	11.9	8.4	6.3	4.5	2.8	0.3	30.7	15.4	15.4	38.5				280
11.0	8.4	11.6	16.0	14.5	11.5	5.6	2.0																			281
9.6	11.7	13.2	16.3	11.0	9.5	2.4	0.8	6.2	11.3	17.7	25.1	18.7	8.8	8.3	1.6	1.4	0.7	0.2	10.1	49.7	31.9	5.3	1.8	1.2		282
3.5	3.3	13.9	23.7	25.5	12.8	3.3	1.0	8.3	11.7	20.8	12.5	19.2	17.5	6.7	1.7	0.8	0.8		12.5	37.5	12.5		37.5			283
7.1	9.0	11.8	12.2	17.1	10.6	2.1	0.8	8.0	17.5	22.5	14.8	11.5	8.1	9.0	3.2	2.6	2.5	0.3	54.9	39.0	6.1					284
1.7	3.8	6.4	11.5	13.2	24.2	18.2	12.0	2.6	23.7	23.7	13.2	18.4	5.3	2.6	2.6		2.6	5.3	25.0	16.7	50.0	8.3				285
4.8	9.0	18.1	17.4	17.2	18.8	3.6	0.9	6.4	22.2	7.9	23.8	20.6	6.4	7.9		4.8			6.2	18.8	37.5	37.5				286
8.7	13.0	20.9	15.5	11.9	9.2	3.0	0.5	0.8	25.2	26.8	20.5	14.2	4.7	2.3	3.9	0.8		0.8								287
2.9	6.6	10.0	15.3	14.8	24.8	7.4	0.3		5.0		30.0	30.0	10.0	10.0			5.0	10.0	25.0	33.3	41.7					288
4.1	3.5	6.2	7.2	9.9	17.3	17.0	13.5	5.9	8.8	20.6	8.8	8.8		14.7	8.8	3.0	11.8	8.8	5.3	63.1	10.5	15.8	5.3			289
5.7	7.5	11.6	12.3	14.4	21.3	9.7	5.4	4.3	4.3			13.1	26.1	13.1	8.7	21.7	8.7		18.2	46.5	23.7	5.4	5.8		0.4	290
9.1	10.1	14.9	15.2	18.7	13.6	2.9	0.5		7.1	35.7	21.5	7.1	7.1	21.5					28.6		57.1		14.3			291
5.7	5.7	51.5	5.7	17.1	5.7	8.6				18.1	5.5	40.0	3.6	21.8	5.5	5.5			4.5	4.5	36.4	27.3	18.2	9.1		292
5.8	10.5	17.3	17.5	17.2	16.7	4.7	0.9				25.0	25.0	25.0	25.0					1.6	45.3	28.1	15.6			9.4	293
3.5	3.8	21.6	26.3	21.1	12.7	3.6	1.0	7.5	14.7	13.7	25.9	23.7	9.0	4.7	0.4	0.4					66.7	33.3				294
2.7	5.9	16.5	15.6	27.1	14.0	4.8	2.1	2.9	3.2	19.9	15.4	33.4	6.4	6.8	4.2	2.3	4.2	1.3	20.0	40.0	10.0		30.0			295
7.2	5.1	7.9	11.7	16.1	20.5	10.3	3.0																			296

TABLE 68.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY SPECIFIED INDUSTRIES—PER CENT DISTRI- WAGE-EARNERS AND OF EACH CLASS, NUMBER OF ESTABLISHMENTS, AND PER CENT NUMBER OF ALL

	INDUSTRY.	Number of establishments.	Per cent number all wage-earners included in statistics of weekly earnings forms of greatest number, all establishments.	AVERAGE WEEKLY EARNINGS.				MEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).				
				All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.
297	Tin and terne plate	17	63.3	$10.72	$11.42	$6.63	$6.00	0.5	0.2	0.5	0.9	0.7
298	Tinfoil	6	76.6	8.16	10.82	4.90			5.1	4.3	7.4	8.3
299	Tinware	234	62.7	8.09	8.99	5.11	3.58	11.4	6.2	6.2	5.7	7.4
300	Tobacco, chewing and smoking, and snuff	229	54.8	5.69	6.86	4.85	2.37	7.6	11.2	13.4	13.3	13.1
301	Tobacco, cigars and cigarettes	9,033	51.4	8.72	11.14	5.97	3.00	2.7	3.7	4.1	5.0	5.7
302	Tools, not elsewhere specified	398	64.0	10.73	11.08	5.15	4.14	1.3	2.2	2.5	4.1	6.1
303	Toys and games	79	34.3	7.54	8.55	6.00	3.56	2.5	5.5	6.7	7.9	11.6
304	Trunks and valises	230	43.0	9.59	10.20	5.46	3.61	3.0	3.1	5.1	6.1	8.0
305	Turpentine and rosin	383	17.4	5.22	5.23	3.00	2.38	4.8	10.4	20.5	37.6	14.0
306	Type founding	16	81.7	12.59	15.25	5.93	3.07	1.7	2.5	3.6	3.7	3.0
307	Typewriters and supplies	45	64.1	11.86	12.31	7.54	4.00	0.7	0.9	2.2	3.4	3.6
308	Umbrellas and canes	106	23.5	7.63	10.17	6.11	3.24	1.2	4.9	5.4	6.8	10.2
309	Upholstering materials	120	34.2	8.60	9.83	6.16	2.88	0.9	1.2	2.7	3.5	9.8
310	Varnishes	129	52.1	12.46	12.79	6.00	4.25	0.2	1.9	2.3	2.0	4.2
311	Vault lights and ventilators	15	42.0	12.86	12.86					5.7	1.6	3.3
312	Vinegar and cider	424	56.0	9.55	9.81	4.20	3.67	1.3	1.3	1.1	2.1	5.9
313	Wall paper	21	47.8	9.99	11.28	5.04	3.61	0.2	1.5	7.4	6.3	9.7
314	Washing machines and clothes wringers	54	48.6	9.06	9.22	7.50	3.86	1.5	2.3	3.5	5.3	9.4
315	Watch and clock materials	11	70.6	9.39	11.58	6.65	4.33		2.8	1.1	4.6	5.7
316	Watch cases	12	45.5	10.74	12.61	6.02	2.78	1.8	5.3	4.4	4.9	4.7
317	Watches	7	45.9	12.73	16.16	8.93		0.2	1.3	2.6	1.2	2.3
318	Wheelbarrows	13	27.3	8.21	8.25		2.00	7.3	4.2	4.2	2.6	15.7
319	Whips	36	51.3	8.47	10.15	5.87	4.27	0.2	0.2	6.3	4.1	8.4
320	Windmills	40	75.9	10.82	10.82			1.3	2.0	2.3	1.5	2.9
321	Window shades and fixtures	105	50.3	8.31	9.84	5.51	3.65	2.6	6.6	7.8	5.1	6.8
322	Wire	14	51.6	11.00	11.23	5.55	4.70	0.7	1.5	1.3	2.0	2.8
323	Wirework, including wire rope and cable	374	56.9	9.92	10.94	6.26	3.46	1.2	2.3	3.9	4.0	6.9
324	Wood carpet	11	55.1	16.45	16.61	6.00	2.67		0.3	1.2	1.2	2.1
325	Wood distillation, not including turpentine and rosin	69	43.5	10.26	10.26			0.1	0.1	1.2	1.0	4.1
326	Wood preserving	13	54.9	7.89	7.96		2.25	12.6	5.5	3.4	7.9	10.2
327	Wood, turned and carved	584	42.4	8.67	8.89	4.40	3.68	2.4	3.1	6.8	8.3	10.6
328	Woodenware, not elsewhere specified	114	45.8	8.88	9.80	4.91	3.84	3.1	1.3	2.5	2.8	5.8
329	Wool pulling	21	62.6	10.56	10.57		7.00	1.9		1.0	2.4	6.4
330	Wool scouring	11	55.5	11.69	11.91	8.63	6.00	0.7	0.2	0.2	0.4	1.2
331	Woolen goods	366	53.4	8.23	9.29	6.91	3.83	1.6	1.4	2.9	4.4	10.7
332	Worsted goods	108	58.5	7.91	9.83	6.78	3.82	1.7	1.4	4.6	7.7	9.5
333	All other industries	[1]11	13.6	8.54	10.69	4.35	3.00	2.3	4.0	1.7	4.5	2.3

[1] Embraces cardboard, not made in paper mills, 2; millstones, 2; oil, castor, 2; oil, lard, 2; pens, steel, 1; pulp, from fiber other than wood, 1; sand and emery paper and cloth, 1.

BUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—WITH AVERAGE WEEKLY EARNINGS OF ALL WAGE-EARNERS IN THE STATISTICS FORMS OF GREATEST NUMBER, ALL ESTABLISHMENTS: 1905—Continued.

MEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS)—continued.								WOMEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).											CHILDREN UNDER 16 YEARS (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).							
$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 to $20.	$20 to $25.	$25 and over	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
5.7	20.0	15.3	17.6	10.4	24.5	3.5	0.2	2.8	1.1	1.2	5.8	35.5	50.4	3.2	.....	.....	.....	.....	.....	.....	.....	.....	100.0	.....	.....	297
6.6	4.8	7.1	14.5	17.7	21.9	1.4	0.9	2.4	26.9	21.3	19.9	14.0	8.8	4.9	1.1	0.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	298
7.9	8.1	9.9	13.1	12.1	8.1	2.7	1.2	15.2	18.3	22.2	14.1	9.9	8.0	4.6	3.0	3.0	1.3	0.4	14.5	51.2	27.6	2.8	3.5	0.4	.....	299
10.1	7.2	7.3	7.3	5.5	3.1	0.7	0.2	28.4	16.4	11.3	11.5	13.2	6.5	4.0	2.8	3.9	1.8	0.2	79.9	10.4	6.5	2.1	0.7	0.3	0.1	300
5.3	6.3	7.4	16.1	22.0	16.7	3.6	1.4	11.0	12.7	16.2	16.1	14.0	11.1	6.3	4.3	4.6	2.7	1.0	50.9	28.2	12.0	5.7	2.2	0.6	0.4	301
7.1	8.1	13.4	16.4	20.3	14.9	2.5	1.1	4.3	27.7	17.6	14.2	14.5	9.4	3.8	5.9	2.3	.....	0.3	18.9	21.7	24.5	17.9	13.2	2.8	1.0	302
9.8	9.6	13.4	11.8	11.8	7.0	1.8	0.6	9.0	16.9	10.9	18.2	18.2	11.1	7.4	3.7	4.2	0.2	0.2	18.5	47.9	22.1	4.7	4.7	.....	2.1	303
7.3	8.2	10.5	14.0	17.8	13.2	2.8	0.9	7.4	17.7	22.4	16.0	14.3	5.3	6.4	4.1	5.5	0.7	0.2	19.5	41.5	21.2	11.0	6.8	.....	.....	304
4.8	3.8	1.1	1.5	1.4	0.1	.....	.....	.....	100.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	100.0	.....	.....	.....	.....	.....	.....	305
3.9	3.5	5.4	8.0	15.6	25.9	13.1	10.1	8.3	15.3	17.0	10.7	18.0	10.7	6.0	5.0	6.0	2.0	1.0	47.2	43.1	6.9	2.8	.....	.....	.....	306
5.3	8.1	10.5	17.5	25.2	17.9	3.5	1.2	1.0	2.3	8.9	21.8	15.4	13.4	20.0	8.9	6.8	1.5	.....	11.6	34.6	46.2	3.8	3.8	.....	.....	307
8.0	9.1	6.8	12.7	16.8	13.4	2.9	1.8	3.0	12.7	14.8	19.4	12.4	14.4	10.1	6.4	4.7	1.6	0.5	34.7	34.7	18.4	8.2	2.0	2.0	.....	308
9.2	7.9	27.6	12.9	12.9	7.2	2.2	2.0	5.5	14.7	16.5	15.9	15.7	12.2	4.1	5.4	5.5	3.4	1.1	41.4	46.5	6.9	.....	5.2	.....	.....	309
4.2	5.1	9.3	19.0	26.7	15.1	4.3	5.7	2.2	2.2	28.9	26.7	17.7	2.2	6.7	.....	6.7	6.7	.....	.....	.....	75.0	25.0	.....	.....	.....	310
6.5	3.3	5.7	15.4	20.3	24.4	8.9	4.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	311
8.1	8.5	32.3	14.5	17.5	6.7	0.6	0.1	14.1	14.1	42.4	20.6	3.3	3.3	1.1	1.1	.....	.....	.....	16.7	33.3	33.3	.....	16.7	.....	.....	312
9.3	9.1	15.8	11.3	6.2	6.7	9.4	7.1	5.1	25.1	20.4	20.4	18.0	5.1	4.3	0.8	0.4	0.4	.....	10.9	66.3	16.3	5.4	1.1	.....	.....	313
14.3	10.0	19.5	16.9	8.9	6.8	0.8	0.8	.....	.....	.....	25.0	.....	25.0	25.0	.....	25.0	.....	.....	17.8	28.6	42.9	7.1	.....	3.6	.....	314
5.1	8.5	10.8	14.8	22.7	17.6	4.0	2.3	6.7	4.4	8.9	13.3	15.6	15.6	21.5	8.1	3.0	2.2	0.7	.....	.....	100.0	.....	.....	.....	.....	315
6.0	3.8	5.3	10.8	18.3	24.6	8.0	2.1	3.1	16.4	17.7	20.7	16.8	11.8	5.9	3.7	2.0	1.1	0.8	61.0	12.2	24.4	.....	.....	2.4	.....	316
2.3	1.9	4.5	7.3	14.0	38.6	17.5	6.3	0.6	3.1	4.7	6.0	8.6	15.7	12.6	18.0	18.8	10.0	1.9	.....	.....	.....	.....	.....	.....	.....	317
11.5	12.6	14.1	17.3	3.2	4.7	2.1	0.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	100.0	.....	.....	.....	.....	.....	.....	318
6.2	10.0	18.0	18.9	17.3	8.8	1.4	0.2	14.0	5.1	11.9	9.4	25.9	15.8	10.1	3.2	3.2	0.7	0.7	32.2	21.0	14.5	6.5	12.9	4.8	8.1	319
4.1	8.3	26.6	18.0	16.0	15.4	1.3	0.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	320
5.9	5.9	12.7	12.5	17.7	13.3	2.8	0.3	9.6	14.4	13.4	19.1	18.7	13.2	4.3	3.2	3.0	1.1	.....	32.7	22.5	36.7	.....	6.1	2.0	.....	321
5.0	19.4	16.1	21.1	17.4	9.5	2.8	0.4	6.1	11.2	11.2	24.5	30.6	8.2	5.1	2.1	1.0	.....	.....	10.0	5.0	50.0	35.0	.....	.....	.....	322
7.5	7.9	14.1	16.2	19.0	13.2	2.5	1.3	3.9	11.1	16.2	15.2	22.1	14.6	7.0	4.5	2.6	2.4	0.4	37.7	24.9	20.7	9.5	6.4	0.8	.....	323
2.8	3.1	6.8	6.8	9.5	27.4	38.8	.....	.....	.....	.....	.....	100.0	.....	.....	.....	.....	.....	.....	66.7	.....	33.3	.....	.....	.....	.....	324
4.3	9.2	28.2	31.4	15.2	4.5	0.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	325
13.5	6.8	17.2	6.8	11.4	3.5	0.9	0.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50.0	37.5	12.5	.....	.....	.....	.....	326
12.9	8.8	15.8	10.5	10.9	7.7	2.0	0.2	13.0	21.7	25.6	20.8	13.0	3.9	1.5	.....	0.5	.....	.....	19.8	39.5	28.2	6.8	3.4	1.7	0.6	327
6.1	9.7	28.1	18.4	13.7	7.1	1.1	0.3	16.6	7.7	31.9	13.9	18.6	5.8	3.8	1.1	0.4	0.2	.....	29.0	23.0	16.6	16.6	10.2	4.1	0.5	328
5.1	11.2	11.5	29.7	18.3	11.2	1.0	0.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	100.0	.....	329
2.0	6.8	25.7	14.2	26.6	18.0	2.9	1.1	.....	.....	3.3	.....	13.4	3.3	3.3	76.7	.....	.....	.....	.....	.....	.....	.....	100.0	.....	.....	330
16.4	12.6	15.1	16.7	11.8	4.9	1.0	0.5	3.4	6.0	12.5	16.0	16.5	13.7	9.7	9.5	9.1	3.1	0.5	21.5	35.1	24.7	12.4	4.6	1.3	0.4	331
12.4	10.3	8.5	14.6	17.9	9.6	1.2	0.6	2.6	3.2	13.8	22.6	23.1	9.5	7.7	6.5	6.8	3.3	0.9	20.9	38.3	29.2	7.7	3.3	0.5	0.1	332
4.0	6.3	17.7	12.6	29.1	12.6	2.9	.....	8.1	21.8	42.6	19.5	6.9	1.1	.....	.....	.....	.....	.....	100.0	.....	.....	.....	.....	.....	.....	333

TABLE 69.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY STATES, TERRITORIES, AND GEOGRAPHIC WITH EARNINGS AND NUMBER OF ALL WAGE-EARNERS AND OF EACH CLASS, AVERAGE NUMBER OF

	STATE OR TERRITORY.	Number of establishments.	AVERAGE NUMBER OF WAGE-EARNERS.			TOTAL.	
			Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Earnings.	Number.
1	United States	123,703	2,124,069	488,832	73,855	$33,185,791	3,297,819
2	North Atlantic division	51,554	1,082,980	337,639	37,501	17,454,536	1,726,641
3	New England	15,166	442,923	179,398	19,280	7,251,712	749,993
4	Maine	1,711	22,462	6,392	612	406,537	43,277
5	New Hampshire	810	17,139	8,111	315	270,034	29,874
6	Vermont	859	14,227	2,769	139	185,447	20,065
7	Massachusetts	8,724	281,179	124,181	12,875	4,713,422	487,048
8	Rhode Island	1,092	40,004	17,349	3,186	626,215	68,140
9	Connecticut	1,970	67,912	20,596	2,153	1,050,057	101,589
10	Southern North Atlantic	36,388	640,057	158,241	18,221	10,202,824	976,648
11	New York	19,030	265,409	89,060	3,304	4,476,464	430,475
12	New Jersey	4,153	92,788	23,948	2,966	1,456,513	139,862
13	Pennsylvania	13,205	281,860	45,233	11,951	4,269,847	406,311
14	South Atlantic division	10,181	171,514	39,414	18,440	2,148,821	293,997
15	Northern South Atlantic	5,646	92,584	19,235	3,892	1,317,757	148,013
16	Delaware	380	10,070	1,369	231	146,350	15,783
17	Maryland	2,283	37,532	12,641	2,343	564,123	65,601
18	District of Columbia	276	3,575	302	55	53,965	4,836
19	Virginia	1,481	22,112	3,571	877	263,262	34,233
20	West Virginia	1,226	19,295	1,352	386	290,057	27,560
21	Southern South Atlantic	4,535	78,930	20,179	14,548	831,064	145,984
22	North Carolina	1,698	25,095	8,831	6,325	254,059	51,240
23	South Carolina	791	15,567	5,550	4,854	151,687	32,424
24	Georgia	1,520	27,813	4,852	3,271	286,187	46,932
25	Florida	526	10,455	946	98	139,131	15,388
26	North Central division	43,561	665,668	91,507	11,390	10,254,500	965,395
27	Eastern North Central	30,477	542,452	73,994	8,500	8,366,133	785,058
28	Ohio	8,328	172,332	25,512	2,385	2,614,720	245,944
29	Indiana	4,678	86,454	9,551	1,485	1,257,958	124,607
30	Illinois	8,382	157,203	22,338	2,230	2,595,822	224,664
31	Michigan	4,303	76,790	12,174	1,140	1,200,496	120,978
32	Wisconsin	4,786	49,673	4,419	1,260	697,137	68,865
33	Western North Central	13,084	123,216	17,513	2,890	1,888,367	180,337
34	Minnesota	2,779	23,296	3,426	112	355,647	32,314
35	Iowa	2,947	20,381	2,714	438	294,232	30,414
36	Missouri	3,836	49,243	8,595	1,740	778,709	74,944
37	North Dakota	306	744	112	20	12,193	1,032
38	South Dakota	445	1,177	125	20	19,974	1,709
39	Nebraska	1,094	11,618	1,208	244	182,300	16,740
40	Kansas	1,677	16,757	1,333	316	245,312	23,184
41	South Central division	9,751	112,802	12,387	5,298	1,451,234	174,298
42	Eastern South Central	5,400	68,133	9,339	4,343	844,296	107,392
43	Kentucky	2,251	22,040	4,112	942	298,109	35,590
44	Tennessee	1,742	20,518	2,949	1,385	248,431	33,092
45	Alabama	786	17,545	1,794	1,625	200,255	26,191
46	Mississippi	621	8,030	484	391	97,501	12,519
47	Western South Central	4,351	44,669	3,048	955	606,938	66,906
48	Louisiana	748	12,055	1,677	415	156,038	17,043
49	Arkansas	1,015	11,741	195	171	141,341	17,780
50	Indian Territory	332	1,319	49	25	23,286	2,153
51	Oklahoma	454	1,442	130	37	23,199	2,253
52	Texas	1,802	18,112	997	307	263,074	27,677
53	Western division	8,632	90,321	7,869	1,214	1,855,489	135,954
54	Rocky Mountain	1,616	15,936	890	232	350,590	23,429
55	Montana	227	3,646	117	51	85,462	4,698
56	Idaho	183	864	48	20	22,931	1,548
57	Wyoming	101	1,620	29	5	34,254	2,175
58	Colorado	999	8,156	689	127	181,739	12,856
59	New Mexico	106	1,650	7	29	26,204	2,152
60	Basin and Plateau	515	4,936	284	82	95,912	6,518
61	Arizona	114	2,860	22	11	54,875	3,398
62	Utah	313	1,641	255	67	29,423	2,466
63	Nevada	88	435	7	4	11,614	654
64	Pacific	6,501	69,449	6,695	900	1,408,987	106,007
65	Washington	1,331	15,241	545	45	287,020	20,734
66	Oregon	822	7,748	686	75	128,972	10,249
67	California	4,348	46,460	5,464	780	992,995	75,024
68	Alaska	24	784	16	12	21,211	1,534

DIVISIONS—NUMBER OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—IN EACH GROUP OF EARNINGS, MEN, WOMEN, AND CHILDREN EMPLOYED DURING THE YEAR, AND NUMBER OF ESTABLISHMENTS: 1905.

MEN 16 YEARS AND OVER (DISTRIBUTION OF NUMBER BY EARNINGS).															
Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	
$29,240,287	2,619,053	56,346	57,597	87,739	103,429	161,940	196,981	207,954	343,812	409,483	450,568	385,647	106,046	51,511	1
14,693,604	1,287,449	17,883	22,503	34,669	45,780	71,560	99,655	111,020	168,943	208,677	229,010	199,800	51,672	26,277	2
5,734,569	519,883	5,943	7,043	13,843	20,864	34,897	46,157	46,025	69,251	83,201	92,257	77,156	16,447	6,799	3
342,291	33,448	491	469	650	855	2,322	3,024	2,976	7,567	5,669	5,235	3,399	581	20	4
205,379	20,473	310	354	540	917	1,665	2,346	1,997	3,454	3,529	3,056	1,945	299	61	5
165,102	16,688	367	321	429	188	1,236	2,133	1,962	3,044	2,473	2,314	1,589	255	77	6
3,652,719	327,717	3,380	4,176	8,920	13,937	22,104	28,055	28,425	39,951	51,788	59,202	51,613	11,401	4,765	7
482,791	44,978	467	703	1,385	2,107	3,584	5,172	4,467	4,576	6,808	7,825	6,031	1,239	614	8
886,287	76,579	928	1,020	1,919	2,560	3,986	5,427	6,198	10,659	12,934	14,625	12,579	2,672	1,072	9
8,959,035	767,566	11,940	15,460	20,826	24,916	36,663	53,498	64,995	99,692	125,476	136,753	122,644	35,225	19,478	10
3,755,060	318,390	5,007	7,174	9,742	11,403	15,534	21,706	23,450	39,985	49,574	57,275	51,666	16,574	9,300	11
1,276,999	108,669	1,738	2,311	3,151	3,660	5,229	7,245	9,125	13,517	16,901	18,362	19,511	5,247	2,672	12
3,926,976	340,507	5,195	5,975	7,933	9,853	15,900	24,547	32,420	46,190	59,001	61,116	51,467	13,404	7,506	13
1,874,151	223,383	14,195	14,544	23,805	23,347	29,701	21,864	16,030	17,738	18,802	19,066	16,700	4,576	3,015	14
1,181,990	117,968	4,899	4,414	5,465	6,415	12,019	12,372	11,055	13,282	14,609	14,662	12,813	3,514	2,449	15
135,390	13,544	402	460	510	734	1,073	1,163	1,677	1,087	2,310	1,866	1,931	250	81	16
473,295	46,082	1,772	1,983	2,356	2,226	3,635	4,703	4,199	4,858	6,153	6,416	5,215	1,635	931	17
51,532	4,341	125	139	113	127	299	242	213	585	581	720	740	303	154	18
241,781	28,544	1,641	1,237	1,795	2,582	5,371	4,184	2,313	2,271	2,051	2,316	2,011	430	342	19
279,992	25,457	959	595	691	746	1,641	2,080	2,653	4,481	3,514	3,344	2,916	806	941	20
692,161	105,415	9,296	10,130	18,340	16,932	17,682	9,492	4,975	4,456	4,193	4,404	3,887	1,062	566	21
197,094	33,283	2,916	3,568	7,035	5,231	6,248	2,958	1,437	1,322	948	778	649	141	52	22
111,309	20,353	2,562	3,007	4,512	3,218	2,765	1,268	911	832	417	387	334	112	28	23
254,571	37,995	3,153	2,866	5,717	7,258	6,948	3,265	1,934	1,615	1,484	1,673	1,416	451	215	24
129,187	13,784	665	689	1,076	1,225	1,721	2,001	693	687	1,344	1,566	1,488	358	271	25
9,547,927	834,586	14,275	13,450	19,347	23,682	35,757	51,067	66,663	131,502	152,992	156,728	124,169	30,207	14,747	26
7,801,331	680,238	10,109	10,299	15,651	19,090	28,708	42,260	56,466	111,934	121,645	126,503	100,612	24,670	12,291	27
2,435,737	211,989	3,465	3,928	5,585	6,692	9,037	13,456	18,289	32,120	35,623	40,399	31,670	7,275	4,450	28
1,184,102	108,854	2,518	2,099	3,030	3,870	5,852	9,284	11,058	18,490	16,232	17,056	13,193	3,894	2,278	29
2,408,866	194,782	2,938	2,323	3,819	4,904	7,037	9,146	12,225	23,645	37,037	39,863	37,534	10,062	4,249	30
1,109,686	102,936	613	1,120	1,708	2,004	3,968	5,927	8,903	26,143	20,266	18,425	11,140	1,896	823	31
662,940	61,677	575	829	1,509	1,620	2,814	4,447	5,991	11,536	12,487	10,760	7,075	1,543	491	32
1,746,596	154,348	4,166	3,151	3,696	4,592	7,049	8,807	10,197	19,568	31,347	30,225	23,557	5,537	2,456	33
329,437	28,049	376	500	599	691	985	1,139	1,471	3,254	6,582	6,393	4,374	1,263	422	34
273,988	26,132	747	626	675	790	1,353	1,785	2,292	4,391	5,286	4,287	3,081	652	167	35
706,966	62,128	2,057	1,366	1,711	2,131	3,227	4,008	4,003	7,340	10,527	11,730	10,546	2,296	1,186	36
11,287	886	1	7	11	18	29	37	29	85	127	253	224	51	14	37
18,921	1,543	22	15	10	30	32	46	59	176	321	433	337	54	8	38
171,435	14,703	278	225	264	431	446	560	732	1,470	3,883	3,392	2,375	493	154	39
234,562	20,907	685	412	426	501	977	1,232	1,611	2,852	4,621	3,737	2,620	728	505	40
1,363,936	153,150	8,583	6,005	8,543	8,860	22,232	21,704	11,094	18,554	15,326	14,944	12,250	3,239	1,816	41
778,672	91,263	3,918	3,928	6,153	6,339	17,375	14,309	5,915	8,856	7,586	7,596	6,667	1,612	1,009	42
269,836	29,333	1,108	1,216	1,604	1,760	4,113	4,000	2,240	3,086	3,198	3,320	2,433	659	596	43
228,925	28,004	1,368	1,331	2,064	1,773	6,481	4,362	1,576	2,424	1,954	2,026	2,055	407	183	44
186,433	22,459	977	1,025	2,100	2,258	4,344	3,329	1,541	1,469	1,667	1,550	1,603	422	174	45
93,478	11,467	405	356	385	548	2,437	2,618	558	1,877	767	700	576	124	56	46
585,264	61,887	4,665	2,077	2,390	2,521	4,857	7,395	5,179	9,698	7,740	7,348	5,583	1,627	807	47
146,193	14,723	594	494	493	504	1,046	1,733	1,474	2,296	2,181	2,019	1,409	298	182	48
139,031	17,133	1,901	736	941	1,007	1,933	2,388	1,634	2,489	1,691	1,235	801	250	127	49
22,823	2,054	9	14	9	38	68	244	104	501	318	397	251	88	13	50
22,039	2,037	27	21	36	44	83	106	75	526	338	441	294	40	7	51
255,178	25,940	2,134	812	911	928	1,728	2,924	1,892	3,886	3,212	3,256	2,828	951	478	52
1,740,089	119,041	1,410	1,095	1,375	1,759	2,688	2,690	3,012	7,014	13,505	30,251	32,505	16,162	5,575	53
340,737	22,007	235	178	181	242	398	363	509	1,222	1,878	5,537	6,551	3,399	1,314	54
83,968	4,514	20	40	9	30	49	25	20	46	87	964	1,203	1,424	597	55
22,333	1,460			3	4	16	10	11	46	48	648	495	117	62	56
33,964	2,132	29	28	39	22	35	21	43	92	229	428	612	506	48	57
174,509	11,811	111	78	103	124	184	209	280	740	1,145	3,172	4,033	1,149	483	58
25,963	2,090	75	32	27	62	114	98	155	298	369	325	208	203	124	59
93,467	6,044	87	40	58	53	146	86	112	441	705	1,208	1,694	940	474	60
54,588	3,355	80	27	26	22	33	43	47	149	340	628	961	670	329	61
27,399	2,053	6	10	31	26	110	36	61	284	354	446	467	147	75	62
11,480	636	1	3	1	5	3	7	4	8	11	134	266	123	70	63
1,305,885	90,990	1,088	877	1,136	1,464	2,144	2,241	2,391	5,351	10,922	23,506	24,260	11,823	3,787	64
281,969	19,952	285	250	231	232	317	384	734	1,064	2,421	5,699	5,331	2,305	699	65
122,442	9,272	129	85	92	163	258	237	263	797	1,513	2,672	1,910	860	293	66
901,474	61,766	674	542	813	1,069	1,569	1,620	1,394	3,490	6,988	15,135	17,019	8,658	2,795	67
20,580	1,444	....	....	....	1	2	1	135	61	181	569	223	190	81	68

TABLE 69.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY STATES, TERRITORIES, AND GEOGRAPHIC WITH EARNINGS AND NUMBER OF ALL WAGE-EARNERS AND OF EACH CLASS, AVERAGE NUMBER OF MEN,

	STATE OR TERRITORY.	WOMEN 16 YEARS AND OVER (DISTRIBUTION OF NUMBER BY EARNINGS).					
		Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.
1	United States	$3,633,481	588,599	43,858	64,170	88,657	95,674
2	North Atlantic division	2,592,665	395,073	19,914	32,343	52,751	65,069
3	New England	1,423,966	207,381	6,467	11,340	22,912	33,933
4	Maine	59,440	8,684	314	570	1,256	1,455
5	New Hampshire	63,178	9,035	287	418	799	1,327
6	Vermont	19,630	3,170	281	317	348	420
7	Massachusetts	997,840	144,380	4,346	7,770	15,616	23,448
8	Rhode Island	130,195	19,537	356	850	2,500	3,933
9	Connecticut	153,683	22,575	883	1,415	2,393	3,341
10	Southern North Atlantic	1,168,699	187,692	13,447	21,003	29,839	31,136
11	New York	706,850	108,083	7,038	10,925	16,230	16,771
12	New Jersey	167,088	27,690	2,225	3,185	4,444	4,819
13	Pennsylvania	294,761	51,919	4,184	6,893	9,165	9,546
14	South Atlantic division	213,472	48,311	10,461	10,596	10,270	6,901
15	Northern South Atlantic	120,132	24,921	4,551	4,301	4,772	3,747
16	Delaware	9,619	1,874	186	246	302	525
17	Maryland	81,950	16,425	2,431	2,809	3,369	2,408
18	District of Columbia	2,205	431	86	70	53	46
19	Virginia	18,073	4,573	1,611	879	759	546
20	West Virginia	8,285	1,618	237	297	289	222
21	Southern South Atlantic	93,340	23,390	5,910	6,295	5,498	3,154
22	North Carolina	37,452	10,397	2,933	3,372	2,441	1,037
23	South Carolina	24,591	6,406	1,730	1,587	1,541	1,045
24	Georgia	21,741	5,129	1,123	1,183	1,239	861
25	Florida	9,556	1,458	124	153	277	211
26	North Central division	651,782	115,663	10,324	16,763	21,287	19,576
27	Eastern North Central	524,260	93,626	8,452	13,916	17,527	16,059
28	Ohio	168,284	30,989	2,978	5,027	6,203	5,779
29	Indiana	65,966	13,650	2,037	2,703	2,865	2,122
30	Illinois	176,645	27,001	1,570	2,336	3,829	4,300
31	Michigan	84,812	16,405	1,418	2,823	3,352	2,772
32	Wisconsin	28,553	5,581	449	1,027	1,278	1,086
33	Western North Central	127,522	22,037	1,872	2,847	3,760	3,517
34	Minnesota	25,579	4,079	272	549	600	598
35	Iowa	18,063	3,648	593	601	755	545
36	Missouri	63,937	10,617	672	1,103	1.731	1,799
37	North Dakota	840	124	3	7	12	26
38	South Dakota	955	140	[illegible]	12	11	20
39	Nebraska	9,251	1,653	91	219	330	283
40	Kansas	8,897	1,776	232	356	321	246
41	South Central division	68,823	14,689	2,209	3,471	2,992	2,316
42	Eastern South Central	51,177	10,961	1,612	2,723	2,286	1,715
43	Kentucky	24,780	5,015	715	1,026	926	755
44	Tennessee	14,965	3,425	599	943	726	529
45	Alabama	8,809	1,973	260	643	486	301
46	Mississippi	2,623	548	38	111	148	130
47	Western South Central	17,646	3,728	597	748	706	601
48	Louisiana	8,244	1,824	354	349	362	352
49	Arkansas	1,482	359	92	106	58	41
50	Indian Territory	341	64	5	10	11	14
51	Oklahoma	1,000	172	7	22	23	41
52	Texas	6,579	1,309	139	261	252	153
53	Western division	106,231	14,807	950	997	1,357	1,812
54	Rocky Mountain	8,080	1,103	20	51	87	154
55	Montana	1,083	126	8	3	10	11
56	Idaho	465	61		1	9	8
57	Wyoming	273	38	1	3	3	7
58	Colorado	6,203	869	11	44	63	127
59	New Mexico	56	9			2	1
60	Basin and Plateau	1,938	343	10	22	43	171
61	Arizona	225	30			1	11
62	Utah	1,597	299	10	22	41	160
63	Nevada	116	14			1	
64	Pacific	96,213	13,361	920	924	1,227	1,487
65	Washington	4,736	708	43	29	89	113
66	Oregon	5,926	844	63	35	64	108
67	California	85,551	11,809	814	860	1,074	1,266
68	Alaska	508	56				

DIVISIONS—NUMBER OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—IN EACH GROUP OF EARNINGS, WOMEN, AND CHILDREN EMPLOYED DURING THE YEAR, AND NUMBER OF ESTABLISHMENTS: 1905—Continued.

WOMEN 16 YEARS AND OVER (DISTRIBUTION OF NUMBER BY EARNINGS)—continued.							CHILDREN UNDER 16 YEARS (DISTRIBUTION OF NUMBER BY EARNINGS).									
$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
97,311	68,192	47,170	34,050	29,633	14,294	5,590	$312,023	90,167	31,860	28,636	17,905	7,060	3,280	839	587	1
70,131	51,326	37,483	27,396	23,431	11,058	4,171	168,267	44,119	10,028	15,270	11,330	4,720	1,984	511	276	2
41,247	30,194	22,624	17,075	13,795	5,910	1,884	93,177	22,729	3,710	7,458	6,845	2,898	1,293	343	182	3
1,436	1,053	799	663	649	334	155	4,806	1,145	243	311	246	123	123	62	37	4
1,936	1,292	987	333	844	218	44	1,477	366	42	141	114	41	23	5	....	5
624	431	272	208	173	84	3	715	207	57	78	43	13	7	4	5	6
28,335	21,093	16,156	12,109	9,681	4,355	1,471	62,863	14,951	2,048	4,725	4,799	2,188	866	205	120	7
4,653	2,589	1,744	1,295	1,039	443	135	13,229	3,625	966	1,444	927	190	95	2	1	8
4,263	3,736	2,666	1,917	1,409	476	76	10,087	2,435	354	759	716	343	179	65	19	9
28,884	21,132	14,859	10,321	9,636	5,148	2,287	75,090	21,390	6,318	7,812	4,485	1,822	691	168	94	10
15,846	12,390	9,152	6,929	6,938	3,969	1,895	14,554	4,002	875	1,718	919	340	102	31	17	11
4,221	3,332	2,279	1,320	1,070	586	209	12,426	3,503	899	1,333	878	248	109	17	19	12
8,817	5,410	3,428	2,072	1,628	593	183	48,110	13,885	4,544	4,761	2,688	1,234	480	120	58	13
5,028	2,521	1,146	587	398	274	129	61,198	22,303	13,365	6,033	2,094	624	141	36	10	14
3,503	2,059	935	514	334	162	43	15,635	5,124	2,636	1,442	594	311	108	27	6	15
468	99	14	9	18	7	....	1,341	365	90	110	104	57	4	....	....	16
2,358	1,524	743	427	230	94	32	8,878	3,094	1,856	834	217	136	37	10	4	17
77	48	20	12	12	5	2	228	64	10	31	12	5	5	1	....	18
376	198	98	38	35	30	3	3,408	1,116	552	343	115	71	24	11	....	19
224	190	60	28	39	26	6	1,780	485	128	124	146	42	38	5	2	20
1,525	462	211	73	64	112	86	45,563	17,179	10,729	4,591	1,500	313	33	9	4	21
454	114	27	11	8	....	....	19,513	7,560	4,877	2,123	450	90	16	3	1	22
354	102	36	7	1	1	2	15,787	5,665	3,490	1,374	649	144	5	1	1	23
437	156	58	30	28	8	6	9,875	3,808	2,264	1,062	394	72	10	5	1	24
280	90	90	25	27	103	78	388	146	98	32	7	7	1	....	1	25
18,015	11,284	6,983	4,421	4,160	2,064	786	54,791	15,146	4,267	4,973	3,504	1,316	802	176	108	26
14,176	8,954	5,601	3,508	3,222	1,604	607	40,542	11,194	3,138	3,909	2,378	1,011	561	124	73	27
4,176	2,777	1,600	1,043	867	416	123	10,699	2,966	887	1,011	509	302	225	23	9	28
1,944	978	499	219	181	63	39	7,890	2,103	652	598	432	200	140	37	44	29
4,289	3,504	2,299	1,739	1,761	980	394	10,311	2,881	653	1,122	698	290	87	24	7	30
2,969	1,311	876	402	330	105	47	5,998	1,637	460	516	425	138	68	23	7	31
798	384	327	105	83	40	4	5,644	1,607	486	662	314	81	41	17	6	32
3,839	2,330	1,382	913	938	460	179	14,249	3,952	1,129	1,064	1,126	305	241	52	35	33
624	417	344	202	277	137	59	631	186	58	70	41	6	10	1	....	34
435	315	150	90	96	44	15	2,181	634	230	172	148	45	26	5	8	35
2,086	1,270	745	453	452	228	78	7,806	2,199	540	682	694	169	92	13	9	36
19	26	8	5	9	9	....	66	22	10	6	1	5	....	....	....	37
30	12	10	16	10	5	5	98	26	7	6	7	3	2	....	1	38
335	170	71	88	37	18	11	1,614	384	113	41	115	30	63	14	8	39
310	120	54	50	57	19	11	1,853	501	171	87	120	47	48	19	9	40
1,868	863	373	284	214	73	26	18,475	6,459	3,644	1,905	611	183	68	26	22	41
1,281	604	290	231	164	41	14	14,447	5,168	3,132	1,429	448	107	40	8	4	42
666	386	201	171	125	33	11	3,493	1,242	691	375	126	33	12	3	2	43
351	122	66	51	29	7	2	4,541	1,663	978	508	132	26	16	3	....	44
174	75	18	7	8	....	1	5,013	1,759	1,154	421	137	40	6	....	1	45
90	21	5	2	2	1	....	1,400	504	309	125	53	8	6	2	1	46
587	259	83	53	50	32	12	4,028	1,291	512	476	163	76	28	18	18	47
223	128	38	9	4	4	1	1,601	496	233	119	73	36	12	7	16	48
24	16	1	6	7	6	2	828	288	121	117	25	16	5	4	....	49
10	6	1	4	2	1	....	122	35	8	13	6	4	1	2	....	50
35	17	9	6	5	5	2	160	44	12	15	7	3	2	4	1	51
295	92	34	28	32	16	7	1,317	428	137	212	52	17	8	1	1	52
2,269	2,181	1,172	1,338	1,430	825	476	9,169	2,106	555	422	366	217	285	90	171	53
235	124	148	103	102	47	32	1,773	319	47	56	63	28	34	22	69	54
18	14	7	16	23	7	9	411	58	6	4	11	1	5	8	23	55
14	7	....	12	5	2	3	133	27	8	1	8	7	4	....	4	56
6	5	2	5	2	3	1	17	5	3	....	1	1	....	....	....	57
193	98	139	69	71	35	19	1,027	176	10	32	42	17	24	10	41	58
4	....	....	1	1	....	....	185	53	20	19	6	2	1	4	1	59
48	15	10	4	9	6	5	507	131	18	60	17	11	18	5	2	60
7	....	3	....	2	5	1	62	13	1	4	1	4	1	1	1	61
35	15	5	2	5	1	3	427	114	16	56	15	7	16	3	1	62
6	....	2	2	2	....	1	18	4	1	....	1	....	1	1	....	63
1,986	2,042	1,014	1,231	1,319	772	439	6,889	1,656	490	306	286	178	233	63	100	64
161	74	54	54	48	26	17	315	74	18	23	7	7	11	2	6	65
174	146	69	93	54	33	5	604	133	26	25	17	25	27	8	5	66
1,651	1,822	891	1,084	1,217	713	417	5,970	1,449	446	258	262	146	195	53	89	67
....	17	13	24	....	....	2	123	34	1	33	....	....	....	....	....	68

TABLE 70.—CLASSIFIED WEEKLY EARNINGS—UNITED STATES, BY STATES, TERRITORIES, AND GEOGRAPHIC ... OF ESTABLISH-

	STATE OR TERRITORY.	Number of establishments.	MEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).												
			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.
1	United States	123,703	2.2	2.2	3.4	4.0	6.2	7.5	7.9	13.1	15.6	17.2	14.7	4.0	2.0
2	North Atlantic division	51,554	1.4	1.8	2.7	3.6	5.6	7.7	8.6	13.1	16.2	17.8	15.5	4.0	2.0
3	New England	15,166	1.1	1.4	2.7	4.0	6.7	8.9	8.9	13.3	16.0	17.7	14.8	3.2	1.3
4	Maine	1,711	1.5	1.4	1.9	2.6	6.9	9.1	8.9	22.6	16.9	15.7	10.2	1.7	0.6
5	New Hampshire	810	1.5	1.7	2.6	4.5	8.1	11.5	9.8	16.9	17.2	14.9	9.5	1.5	0.3
6	Vermont	859	2.2	1.9	2.6	2.9	7.4	12.8	11.8	18.2	14.8	13.9	9.5	1.5	0.5
7	Massachusetts	8,724	1.0	1.3	2.7	4.2	6.7	8.5	8.7	12.2	15.8	18.1	15.8	3.5	1.5
8	Rhode Island	1,092	1.0	1.6	3.1	4.7	7.9	11.5	9.9	10.2	15.1	17.4	13.4	2.8	1.4
9	Connecticut	1,970	1.2	1.3	2.5	3.4	5.2	7.1	8.1	13.9	16.9	19.1	16.4	3.5	1.4
10	Southern North Atlantic	36,388	1.6	2.0	2.7	3.2	4.8	7.0	8.5	13.0	16.3	17.8	16.0	4.6	2.5
11	New York	19,030	1.6	2.2	3.0	3.6	4.9	6.8	7.4	12.6	15.6	18.0	16.2	5.2	2.9
12	New Jersey	4,153	1.6	2.1	2.9	3.4	4.8	6.7	8.4	12.4	15.6	16.9	18.0	4.8	2.4
13	Pennsylvania	13,205	1.5	1.8	2.3	2.9	4.7	7.2	9.5	13.6	17.3	18.0	15.1	3.9	2.2
14	South Atlantic division	10,181	6.4	6.5	10.7	10.4	13.3	9.8	7.2	7.9	8.4	8.5	7.5	2.0	1.4
15	Northern South Atlantic	5,646	4.1	3.7	4.6	5.4	10.2	10.5	9.4	11.3	12.4	12.4	10.9	3.0	2.1
16	Delaware	380	3.0	3.4	3.8	5.4	7.9	8.6	12.4	8.0	17.0	13.8	14.3	1.8	0.6
17	Maryland	2,283	3.9	4.3	5.1	4.8	7.9	10.2	9.1	10.6	13.4	13.9	11.3	3.5	2.0
18	District of Columbia	276	2.9	3.2	2.6	2.9	6.9	5.6	4.9	13.5	13.4	16.6	17.0	7.0	3.5
19	Virginia	1,481	5.8	4.3	6.3	9.0	18.8	14.7	8.1	8.0	7.2	8.1	7.0	1.5	1.2
20	West Virginia	1,226	3.8	2.3	2.7	2.9	6.5	8.2	10.4	17.6	13.8	13.1	11.5	3.5	3.7
21	Southern South Atlantic	4,535	8.8	9.6	17.4	16.1	16.8	9.0	4.7	4.2	4.0	4.2	3.7	1.0	0.5
22	North Carolina	1,698	8.8	10.7	21.1	15.7	18.8	8.9	4.3	4.0	2.8	2.3	2.0	0.4	0.2
23	South Carolina	791	12.6	14.8	22.2	15.8	13.6	6.2	4.5	4.1	2.0	1.9	1.6	0.6	0.1
24	Georgia	1,520	8.3	7.5	15.1	19.1	18.3	8.6	5.1	4.2	3.9	4.4	3.7	1.2	0.6
25	Florida	526	4.8	5.0	7.8	8.9	12.5	14.5	5.0	5.0	9.7	11.4	10.8	2.6	2.0
26	North Central division	43,561	1.7	1.6	2.3	2.8	4.3	6.1	8.0	15.8	18.3	18.8	14.9	3.6	1.8
27	Eastern North Central	30,477	1.5	1.5	2.3	2.8	4.2	6.2	8.3	16.5	17.9	18.6	14.8	3.6	1.8
28	Ohio	8,328	1.6	1.9	2.6	3.2	4.3	6.3	8.6	15.2	16.8	19.1	14.9	3.4	2.1
29	Indiana	4,678	2.3	1.9	2.8	3.5	5.4	8.5	10.2	17.0	14.9	15.7	12.1	3.6	2.1
30	Illinois	8,382	1.5	1.2	1.9	2.5	3.6	4.7	6.3	12.1	19.0	20.5	19.3	5.2	2.2
31	Michigan	4,303	0.6	1.1	1.7	1.9	3.9	5.8	8.6	25.4	19.7	17.9	10.8	1.8	0.8
32	Wisconsin	4,786	0.9	1.3	2.5	2.6	4.6	7.2	9.7	18.7	20.2	17.5	11.5	2.5	0.8
33	Western North Central	13,084	2.7	2.0	2.4	3.0	4.5	5.7	6.6	12.7	20.3	19.6	15.3	3.6	1.6
34	Minnesota	2,779	1.3	1.8	2.1	2.5	3.5	4.1	5.2	11.6	23.5	22.8	15.6	4.5	1.5
35	Iowa	2,947	2.8	2.4	2.6	3.0	5.2	6.8	8.8	16.8	20.3	16.4	11.8	2.5	0.6
36	Missouri	3,836	3.3	2.2	2.8	3.4	5.2	6.5	6.4	11.8	16.9	18.9	17.0	3.7	1.9
37	North Dakota	306	0.1	0.8	1.2	2.0	3.3	4.2	3.3	9.6	14.3	28.5	25.3	5.8	1.6
38	South Dakota	445	1.4	1.0	0.7	1.9	2.1	3.0	3.8	11.4	20.8	28.1	21.8	3.5	0.5
39	Nebraska	1,094	1.9	1.5	1.8	2.9	3.0	3.8	5.0	10.0	26.4	23.1	16.2	3.4	1.0
40	Kansas	1,677	3.3	2.0	2.0	2.4	4.7	5.9	7.7	13.6	22.1	17.9	12.5	3.5	2.4
41	South Central division	9,751	5.6	3.9	5.6	5.8	14.5	14.2	7.2	12.1	10.0	9.8	8.0	2.1	1.2
42	Eastern South Central	5,400	4.3	4.3	6.7	7.0	19.0	15.7	6.5	9.7	8.3	8.3	7.3	1.8	1.1
43	Kentucky	2,251	3.9	4.1	5.5	6.0	14.0	13.6	7.6	10.5	11.0	11.3	8.3	2.2	2.0
44	Tennessee	1,742	4.9	4.8	7.4	6.3	23.1	15.6	5.6	8.7	7.0	7.2	7.3	1.4	0.7
45	Alabama	786	4.4	4.6	9.4	10.1	19.3	14.8	6.9	6.5	7.4	6.9	7.1	1.9	0.7
46	Mississippi	621	4.0	3.1	3.4	4.8	21.2	22.8	4.9	16.4	6.7	6.1	5.0	1.1	0.5
47	Western South Central	4,351	7.5	3.4	3.9	4.1	7.8	11.9	8.4	15.7	12.5	11.9	9.0	2.6	1.3
48	Louisiana	748	4.0	3.4	3.4	3.4	7.1	11.8	10.0	15.6	14.8	13.7	9.6	2.0	1.2
49	Arkansas	1,015	11.1	4.3	5.5	5.9	11.3	13.9	9.5	14.5	9.9	7.2	4.7	1.5	0.7
50	Indian Territory	332	0.4	0.7	0.4	1.9	3.3	11.9	5.1	24.4	15.5	19.3	12.2	4.3	0.6
51	Oklahoma	454	1.3	1.0	1.8	2.2	4.0	5.2	3.7	25.8	16.6	21.7	14.4	2.0	0.3
52	Texas	1,802	8.2	3.1	3.5	3.6	6.7	11.3	7.3	15.0	12.4	12.5	10.9	3.7	1.8
53	Western division	8,632	1.2	0.9	1.1	1.5	2.3	2.3	2.5	5.9	11.3	25.4	27.3	13.6	4.7
54	Rocky Mountain	1,616	1.1	0.8	0.8	1.1	1.8	1.6	2.3	5.6	8.5	25.2	29.8	15.4	6.0
55	Montana	227	0.4	0.9	0.2	0.7	1.1	0.6	0.4	1.0	1.9	21.4	26.6	31.6	13.2
56	Idaho	183	......	......	0.2	0.3	1.1	0.7	0.7	3.2	3.3	44.4	33.9	8.0	4.2
57	Wyoming	101	1.4	1.3	1.8	1.0	1.6	1.0	2.0	4.3	10.8	20.1	28.7	23.7	2.3
58	Colorado	999	0.9	0.7	0.9	1.0	1.5	1.8	2.4	6.3	9.7	26.9	34.1	9.7	4.1
59	New Mexico	106	3.6	1.5	1.3	3.0	5.4	4.7	7.4	14.3	17.7	15.6	9.9	9.7	5.9
60	Basin and Plateau	515	1.4	0.7	1.0	0.9	2.4	1.4	1.9	7.3	11.7	20.0	28.0	15.5	7.8
61	Arizona	114	2.4	0.8	0.8	0.7	1.0	1.3	1.4	4.4	10.1	18.7	28.6	20.0	9.8
62	Utah	313	0.3	0.5	1.5	1.3	5.3	1.8	3.0	13.8	17.2	21.7	22.8	7.2	3.6
63	Nevada	88	0.2	0.5	0.2	0.8	0.5	1.1	0.6	1.2	1.7	21.1	41.8	19.3	11.0
64	Pacific	6,501	1.2	1.0	1.2	1.6	2.3	2.5	2.6	5.9	12.0	25.8	26.7	13.0	4.2
65	Washington	1,331	1.4	1.2	1.2	1.2	1.6	1.9	3.7	5.3	12.1	28.6	26.7	11.6	3.5
66	Oregon	822	1.4	0.9	1.0	1.8	2.8	2.5	2.8	8.6	16.3	28.8	20.6	9.3	3.2
67	California	4,348	1.1	0.9	1.3	1.7	2.5	2.6	2.3	5.7	11.3	24.5	27.6	14.0	4.5
68	Alaska	24	......	......	......	0.1	0.1	0.1	9.4	4.2	12.5	39.4	15.4	13.2	5.6

[1] Less than one-tenth of 1 per cent.

DIVISIONS—PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—WITH NUMBER
MENTS: 1905.

WOMEN 16 YEARS AND OVER (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).											CHILDREN UNDER 16 YEARS (PER CENT DISTRIBUTION OF NUMBER BY EARNINGS).							
Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
7.5	10.9	15.1	16.3	16.5	11.6	8.0	5.8	5.0	2.4	0.9	35.3	31.8	19.9	7.8	3.6	0.9	0.7	1
5.0	8.2	13.4	16.5	17.8	13.0	9.5	6.9	5.9	2.8	1.0	22.7	34.6	25.7	10.7	4.5	1.2	0.6	2
3.1	5.5	11.0	16.4	19.9	14.6	10.9	8.2	6.6	2.9	0.9	16.3	32.8	30.1	12.8	5.7	1.5	0.8	3
3.6	6.6	14.5	16.8	16.5	12.1	9.2	7.6	7.5	3.8	1.8	21.2	27.2	21.5	10.7	10.8	5.4	3.2	4
3.2	4.6	8.8	14.7	21.5	14.3	10.9	9.8	9.3	2.4	0.5	11.5	38.5	31.1	11.2	6.3	1.4	....	5
8.9	10.0	11.0	13.5	19.7	13.6	8.6	6.6	5.4	2.6	0.1	27.5	37.7	20.8	6.3	3.4	1.9	2.4	6
3.0	5.4	10.8	16.3	19.6	14.6	11.2	8.4	6.7	3.0	1.0	13.7	31.6	32.1	14.6	5.8	1.4	0.8	7
1.8	4.4	12.8	20.1	23.8	13.3	8.9	6.6	5.3	2.3	0.7	26.6	39.8	25.6	5.2	2.6	0.1	0.1	8
3.9	6.3	10.6	14.8	18.9	16.6	11.8	8.5	6.2	2.1	0.3	14.5	31.2	29.4	14.1	7.3	2.7	0.8	9
7.2	11.2	15.9	16.6	15.4	11.3	7.9	5.5	5.1	2.7	1.2	29.5	36.5	21.0	8.5	3.2	0.8	0.5	10
6.5	10.1	15.0	15.5	14.7	11.4	8.5	6.4	6.4	3.7	1.8	21.9	42.9	22.9	8.5	2.6	0.8	0.4	11
8.0	11.5	16.1	17.4	15.2	12.0	8.2	4.8	3.9	2.1	0.8	25.7	38.1	25.0	7.1	3.1	0.5	0.5	12
8.1	13.3	17.7	18.4	17.0	10.4	6.6	4.0	3.1	1.1	0.3	32.7	34.3	19.4	8.9	3.4	0.9	0.4	13
21.6	21.9	21.3	14.3	10.4	5.2	2.4	1.2	0.8	0.6	0.3	59.9	27.1	9.4	2.8	0.6	0.2	(1)	14
18.3	17.3	19.1	15.0	14.1	8.3	3.7	2.1	1.3	0.6	0.2	51.5	28.1	11.6	6.1	2.1	0.5	0.1	15
9.9	13.1	16.1	28.0	25.0	5.3	0.7	0.5	1.0	0.4	....	24.7	30.1	28.5	15.6	1.1	....	....	16
14.8	17.1	20.5	14.7	14.3	9.3	4.5	2.6	1.4	0.6	0.2	60.0	27.0	7.0	4.4	1.2	0.3	0.1	17
19.9	16.2	12.3	10.7	17.9	11.1	4.6	2.8	2.8	1.2	0.5	15.6	48.4	18.8	7.8	7.8	1.6	....	18
35.2	19.2	16.6	11.9	8.2	4.3	2.2	0.8	0.8	0.7	0.1	49.5	30.7	10.3	6.4	2.1	1.0	....	19
14.6	18.4	17.9	13.7	13.9	11.7	3.7	1.7	2.4	1.6	0.4	26.4	25.6	30.1	8.7	7.8	1.0	0.4	20
25.3	26.9	23.5	13.5	6.5	2.0	0.9	0.3	0.3	0.5	0.3	62.5	26.7	8.7	1.8	0.2	0.1	(1)	21
28.2	32.4	23.5	10.0	4.4	1.1	0.2	0.1	0.1	....	....	64.5	28.1	6.0	1.2	0.2	(1)	(1)	22
27.0	24.8	24.1	16.3	5.5	1.6	0.6	0.1	(1)	(1)	(1)	61.6	24.3	11.5	2.5	0.1	(1)	(1)	23
21.9	23.1	24.2	16.8	8.5	3.0	1.1	0.6	0.5	0.2	0.1	59.5	27.9	10.3	1.9	0.3	0.1	(1)	24
8.5	10.5	19.0	14.5	19.2	6.2	6.2	1.7	1.8	7.1	5.3	67.1	21.9	4.8	4.8	0.7	....	0.7	25
8.9	14.5	18.4	16.9	15.6	9.8	6.0	3.8	3.6	1.8	0.7	28.2	32.8	23.1	8.7	5.3	1.2	0.7	26
9.0	14.9	18.7	17.2	15.1	9.6	6.0	3.7	3.4	1.7	0.7	28.0	34.9	21.2	9.0	5.0	1.2	0.7	27
9.6	16.2	20.0	18.6	13.5	9.0	5.2	3.4	2.8	1.3	0.4	29.9	34.1	17.1	10.2	7.6	0.8	0.3	28
14.9	19.8	21.0	15.5	14.2	7.2	3.7	1.6	1.3	0.5	0.3	31.0	28.4	20.5	9.5	6.7	1.8	2.1	29
5.8	8.7	14.2	15.9	15.9	13.0	8.5	6.5	6.5	3.6	1.4	22.7	38.9	24.3	10.1	3.0	0.8	0.2	30
8.7	17.2	20.4	16.9	18.1	8.0	5.3	2.5	2.0	0.6	0.3	28.1	31.5	26.0	8.4	4.2	1.4	0.4	31
8.0	18.4	22.9	19.4	14.3	6.9	5.9	1.9	1.5	0.7	0.1	30.2	41.2	19.5	5.0	2.6	1.1	0.4	32
8.5	12.9	17.1	16.0	17.4	10.6	6.3	4.1	4.2	2.1	0.8	28.6	26.9	28.5	7.7	6.1	1.3	0.9	33
6.7	13.5	14.7	14.7	15.3	10.2	8.4	4.9	6.8	3.4	1.4	31.2	37.6	22.1	3.2	5.4	0.5	....	34
16.3	16.5	20.7	15.0	11.9	8.6	4.1	2.7	2.6	1.2	0.4	36.3	27.1	23.3	7.1	4.1	0.8	1.3	35
6.3	10.4	16.3	16.9	19.7	12.0	7.0	4.3	4.3	2.1	0.7	24.5	31.0	31.6	7.7	4.2	0.6	0.4	36
2.4	5.6	9.7	21.0	15.3	21.0	6.4	4.0	7.3	7.3	....	45.5	27.3	4.5	22.7	....	....	....	37
6.4	8.6	7.9	14.3	21.4	8.6	7.1	11.4	7.1	3.6	3.6	26.9	23.1	26.9	11.5	7.7	....	3.9	38
5.5	13.2	20.0	17.1	20.3	10.3	4.3	5.3	2.2	1.1	0.7	29.4	10.7	30.0	7.8	16.4	3.6	2.1	39
13.1	20.0	18.1	13.8	17.5	6.8	3.0	2.8	3.2	1.1	0.6	34.1	17.4	23.9	9.4	9.6	3.8	1.8	40
15.0	23.6	20.4	15.7	12.7	5.9	2.6	1.9	1.5	0.5	0.2	56.4	29.5	9.5	2.8	1.1	0.4	0.3	41
14.7	24.8	20.9	15.7	11.7	5.5	2.6	2.1	1.5	0.4	0.1	60.6	27.6	8.7	2.1	0.8	0.1	0.1	42
14.3	20.5	18.5	15.1	13.3	7.7	4.0	3.4	2.4	0.6	0.2	55.6	30.3	10.1	2.6	1.0	0.2	0.2	43
17.5	27.5	21.2	15.4	10.3	3.6	1.9	1.5	0.8	0.2	0.1	58.8	30.5	7.9	1.6	1.0	0.2	....	44
13.2	32.6	24.6	15.3	8.8	3.8	0.9	0.4	0.4	....	(1)	65.6	23.9	7.8	2.3	0.3	....	0.1	45
6.9	20.3	27.0	23.7	16.4	3.8	0.9	0.4	0.4	0.2	....	61.3	24.8	10.5	1.6	1.2	0.4	0.2	46
16.0	20.1	18.9	16.1	15.8	7.0	2.2	1.4	1.3	0.9	0.3	39.6	36.9	12.6	5.9	2.2	1.4	1.4	47
19.4	19.1	19.9	19.3	12.2	7.0	2.1	0.5	0.2	0.2	0.1	47.0	24.0	14.7	7.3	2.4	1.4	3.2	48
25.6	29.5	16.2	11.4	6.7	4.4	0.3	1.7	1.9	1.7	0.6	42.0	40.6	8.7	5.6	1.7	1.4	....	49
7.8	15.6	17.2	21.9	15.6	9.4	1.6	6.2	3.1	1.6	....	25.7	37.2	17.1	11.4	2.9	5.7	....	50
4.1	12.8	13.4	23.8	20.3	9.9	5.2	3.5	2.9	2.9	1.2	27.3	34.1	15.9	6.8	4.5	9.1	2.3	51
10.6	19.9	19.3	11.7	22.5	7.0	2.6	2.2	2.5	1.2	0.5	32.0	49.5	12.2	4.0	1.9	0.2	0.2	52
6.4	6.7	9.2	12.3	15.3	14.7	7.9	9.0	9.7	5.6	3.2	26.4	20.0	17.4	10.3	13.5	4.3	8.1	53
1.8	4.6	7.9	14.0	21.3	11.2	13.4	9.3	9.3	4.3	2.9	14.7	17.6	19.7	8.8	10.7	6.9	21.6	54
6.4	2.4	7.9	8.7	14.3	11.1	5.6	12.7	18.2	5.6	7.1	10.3	6.9	19.0	1.7	8.6	13.8	39.7	55
....	1.6	14.8	13.1	22.9	11.5	....	19.7	8.2	3.3	4.9	29.7	3.7	11.1	25.9	14.8	....	14.8	56
2.6	7.9	7.9	18.4	15.8	13.1	5.3	13.2	5.3	7.9	2.6	60.0	....	20.0	20.0	....	....	....	57
1.3	5.1	7.2	14.6	22.2	11.3	16.0	7.9	8.2	4.0	2.2	5.7	18.2	23.9	9.6	13.6	5.7	23.3	58
....	....	22.2	11.1	44.5	....	....	11.1	11.1	....	....	37.7	35.9	11.3	3.8	1.9	7.5	1.9	59
2.9	6.4	12.5	49.9	14.0	4.4	2.9	1.2	2.6	1.7	1.5	13.7	45.8	13.0	8.4	13.7	3.8	1.6	60
....	....	3.3	36.7	23.3	....	10.0	....	6.7	16.7	3.3	7.7	30.7	7.7	30.8	7.7	7.7	7.7	61
3.3	7.4	13.7	53.5	11.7	5.0	1.7	0.7	1.7	0.3	1.0	14.0	49.1	13.2	6.2	14.0	2.6	0.9	62
....	....	7.1	....	42.9	....	14.3	14.3	14.3	....	7.1	25.0	....	25.0	....	25.0	25.0	....	63
6.9	6.9	9.2	11.1	14.8	15.3	7.6	9.2	9.9	5.8	3.3	29.6	18.5	17.3	10.7	14.1	3.8	6.0	64
6.1	4.1	12.6	16.0	22.7	10.4	7.6	7.6	6.8	3.7	2.4	24.3	31.1	9.5	9.5	14.8	2.7	8.1	65
7.5	4.1	7.6	12.8	20.6	17.3	8.2	11.0	6.4	3.9	0.6	19.5	18.8	12.8	18.8	20.3	6.0	3.8	66
6.9	7.3	9.1	10.7	14.0	15.4	7.6	9.2	10.3	6.0	3.5	30.8	17.8	18.1	10.1	13.5	3.6	6.1	67
....	....	....	....	....	30.3	23.2	42.9	....	....	3.6	2.9	97.1	....	....	....	....	....	68

TABLE 71.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE SELECTED INDUSTRIES, BY STATES, TERRITO- CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND AVERAGE WEEKLY EARNINGS, AND NUMBER

AGRICULTURAL IMPLEMENTS.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS.				TOTAL.		MEN 16 YEARS AND OVER.											
			All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Earnings.	Number.	Earnings.	Number.	Per cent distribution of number by earnings.								
											Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	362	$10.90	$10.97	$5.75	$3.12	$338,090	31,016	$336,653	30,679	1.4	1.5	2.4	3.0	5.2	7.5	11.1	15.9	16.2
2	North Atlantic division	88	10.48	10.53	4.76	2.84	54,716	5,222	54,562	5,182	1.3	1.5	2.4	2.4	5.6	9.9	13.8	16.6	15.9
3	Maine	7	10.45	10.45	......	......	397	38	397	38	......	......	......	......	2.6	5.3	......	47.4	21.0
4	Massachusetts	6	10.44	10.46	4.00	......	4,249	407	4,245	406	0.7	1.0	1.5	2.9	8.4	11.8	18.5	9.1	17.5
5	New York	44	10.91	10.96	4.94	3.00	32,370	2,968	32,268	2,945	1.0	0.9	2.3	1.7	4.9	8.6	12.5	16.4	16.3
6	New Jersey	8	9.56	9.56	......	......	3,003	314	3,003	314	......	2.9	2.6	1.9	3.2	10.2	23.2	31.5	8.9
7	Pennsylvania	23	9.83	9.90	4.00	2.77	14,697	1,495	14,649	1,479	2.4	2.6	3.0	3.6	6.9	11.9	13.7	14.9	15.9
8	South Atlantic division	24	6.11	6.40	3.00	1.98	6,107	1,000	5,973	933	13.5	8.0	16.2	17.3	12.5	9.2	4.8	4.1	3.9
9	Virginia	5	7.26	7.26	......	......	1,248	172	1,248	172	12.8	2.9	6.4	9.9	19.2	14.5	9.3	7.5	7.0
10	North Carolina	9	7.64	7.73	......	4.00	588	77	580	75	......	1.3	18.7	13.3	20.0	12.0	2.7	8.0	2.7
11	Georgia	10	5.69	6.04	3.00	1.92	4,271	751	4,145	686	15.2	10.1	18.4	19.5	10.0	7.6	3.9	2.8	3.2
12	North Central division	203	11.26	11.31	5.97	4.30	262,047	23,275	261,019	23,082	0.9	1.0	1.8	2.3	4.1	6.8	11.2	16.8	17.4
13	Ohio	40	10.92	10.96	6.92	3.00	56,267	5,152	55,918	5,101	0.7	1.2	2.1	2.3	3.6	7.6	15.1	15.4	18.0
14	Indiana	25	11.04	11.07	3.33	2.80	24,284	2,200	24,260	2,192	0.7	1.3	3.5	3.9	5.2	10.3	15.0	12.1	14.2
15	Illinois	44	11.82	11.86	5.20	4.50	97,784	8,276	97,485	8,218	1.3	0.8	1.5	2.1	3.2	4.5	8.6	18.4	15.1
16	Michigan	28	11.09	11.14	6.00	3.53	30,531	2,752	30,465	2,734	0.2	0.3	1.4	2.0	2.4	6.5	6.8	15.8	27.7
17	Wisconsin	32	11.27	11.35	6.20	5.24	40,740	3,615	40,479	3,567	0.4	0.7	0.9	1.8	5.7	6.9	12.5	19.0	16.8
18	Minnesota	8	9.98	9.98	......	......	399	40	399	40	......	......	2.5	......	7.5	15.0	......	22.5	17.5
19	Iowa	7	9.13	9.24	5.00	2.50	4,783	524	4,758	515	4.5	6.4	4.1	3.5	9.1	12.2	6.8	17.5	12.6
20	Missouri	15	10.07	10.07	......	......	5,822	578	5,822	578	0.5	0.4	2.4	3.6	8.3	11.2	14.5	17.5	16.3
21	Kansas	4	10.41	10.46	......	4.00	1,437	138	1,433	137	......	......	3.6	2.9	8.8	13.9	18.2	5.1	19.0
22	South Central division	11	7.62	7.80	6.00	2.67	6,239	819	6,143	788	1.7	9.5	6.1	9.5	27.0	11.2	6.7	5.7	7.2
23	Tennessee	8	7.40	7.59	6.00	2.67	5,530	747	5,434	716	1.1	10.5	6.4	10.3	28.8	9.8	7.0	5.3	7.0
24	Texas	3	9.85	9.85	......	......	709	72	709	72	6.9	......	2.8	1.4	9.7	25.0	4.2	9.7	9.7
25	Western division	18	14.36	14.44	......	4.25	7,106	495	7,089	491	0.2	......	1.2	1.2	2.4	3.1	0.6	7.5	6.3
26	California	18	14.36	14.44	......	4.25	7,106	495	7,089	491	0.2	......	1.2	1.2	2.4	3.1	0.6	7.5	6.3
27	All other states	[1]18	9.15	9.20	4.00	......	1,875	205	1,867	203	3.9	1.5	0.5	3.4	14.3	22.2	7.9	12.8	10.3

BOOTS AND SHOES.

	STATE OR TERRITORY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	745	$10.24	$11.88	$7.60	$3.56	$941,674	92,002	$702,713	59,142	1.7	2.4	3.5	4.4	6.0	6.6	6.9	9.0	14.6
2	North Atlantic division	593	10.62	12.17	7.89	3.75	785,924	73,971	592,105	48,657	1.5	1.9	3.0	3.9	5.6	6.4	6.8	9.0	15.2
3	Maine	22	10.25	11.24	7.85	2.00	19,590	1,911	15,246	1,356	2.1	1.4	1.6	3.8	6.3	6.7	9.0	9.1	19.6
4	New Hampshire	24	9.23	10.35	7.31	4.30	45,742	4,956	33,221	3,209	3.1	2.2	4.0	5.6	5.9	8.7	8.0	11.6	18.3
5	Massachusetts	401	11.18	12.79	8.26	4.01	621,169	55,573	469,201	36,690	1.1	1.4	2.4	3.2	5.1	5.6	6.2	8.8	14.6
6	Connecticut	3	9.33	10.05	6.75	......	681	73	573	57	......	5.3	10.5	7.0	8.8	5.3	10.5	8.8	21.0
7	New York	71	9.35	10.64	7.03	3.02	66,017	7,064	49,857	4,686	2.2	2.7	4.6	6.2	7.8	9.5	9.3	9.9	16.1
8	New Jersey	21	8.61	10.40	6.47	3.26	8,001	929	5,604	539	1.9	1.9	5.2	5.9	5.6	8.5	7.0	10.8	12.8
9	Pennsylvania	51	7.14	8.68	5.06	3.04	24,724	3,465	18,403	2,120	4.2	7.0	9.2	8.8	10.1	10.0	8.9	6.9	15.3
10	South Atlantic division	9	7.71	9.37	5.92	2.60	2,700	350	1,884	201	4.0	2.5	8.0	9.4	9.4	7.5	5.0	9.9	18.4
11	Maryland	6	7.77	9.50	5.92	2.68	2,648	341	1,833	193	4.1	2.6	7.3	8.8	8.3	7.8	5.2	9.8	19.2
12	North Carolina	3	5.78	6.38	......	1.00	52	9	51	8	......	......	25.0	25.0	37.5	......	......	12.5	......
13	North Central division	104	8.68	10.61	6.52	3.43	140,782	16,228	99,422	9,371	2.6	5.4	6.1	6.5	7.6	7.2	7.6	8.6	11.5
14	Ohio	30	8.26	10.13	6.16	3.25	74,707	9,046	51,931	5,127	2.8	6.3	7.2	7.3	7.8	7.4	7.4	9.4	11.3
15	Indiana	3	7.80	9.18	5.38	2.55	2,035	261	1,598	174	......	5.8	7.5	8.0	9.8	9.2	12.6	12.6	12.1
16	Illinois	21	8.21	9.91	6.38	2.65	7,938	967	5,610	566	3.4	6.0	8.8	6.0	6.4	5.5	6.2	9.0	16.1
17	Michigan	11	8.63	10.21	6.12	3.44	4,718	547	3,543	347	2.0	2.6	5.5	2.9	7.2	8.9	7.5	12.1	14.1
18	Wisconsin	17	9.13	10.87	6.36	3.97	4,995	547	3,860	355	2.8	2.8	3.4	7.3	7.3	9.9	8.2	11.0	13.5
19	Minnesota	7	9.67	11.07	7.13	3.00	9,576	990	7,209	651	0.1	6.6	6.1	7.1	7.8	6.0	4.0	9.1	11.7
20	Iowa	3	8.29	9.93	5.99	3.00	1,476	178	1,063	107	6.5	11.2	8.4	3.7	8.4	1.9	4.7	8.4	9.4
21	Missouri	12	9.57	12.04	7.65	3.69	35,337	3,692	24,608	2,044	2.6	3.2	2.9	4.8	7.2	7.0	9.3	5.1	9.7
22	South Central division	8	8.44	8.91	5.00	2.67	405	48	392	44	......	6.8	......	22.7	4.6	13.6	2.3	6.8	18.2
23	Louisiana	4	7.00	7.30	5.00	2.00	175	25	168	23	......	......	......	43.5	4.4	26.1	......	8.7	13.0
24	Texas	4	10.00	10.67	......	3.00	230	23	224	21	......	14.3	......	......	4.8	......	4.8	4.8	23.8
25	Western division	17	11.07	12.04	8.05	4.00	5,091	460	4,214	350	0.3	2.8	3.1	4.3	8.5	8.3	2.3	6.6	10.0
26	Washington	3	13.08	13.08	......	......	314	24	314	24	4.2	4.2	......	......	......	4.2	......	......	4.1
27	California	14	10.96	11.96	8.05	4.00	4,777	436	3,900	326	......	2.8	3.4	4.6	8.9	8.9	2.4	6.7	10.7
28	All other states	[2]14	7.17	9.05	5.66	2.72	6,772	945	4,696	519	3.3	3.9	6.0	6.9	9.8	10.6	8.5	13.9	14.6

[1] Includes Alabama, 1; Arkansas, 1; Colorado, 1; Kentucky, 2; Maryland, 2; Nebraska, 1; New Hampshire, 2; Oregon, 1; South Carolina, 2; South Dakota, 2; Vermont, 2; West Virginia, 1.

RIES, AND GEOGRAPHIC DIVISIONS—PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND OF ALL WAGE-EARNERS AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905.

AGRICULTURAL IMPLEMENTS.

MEN 16 YEARS AND OVER—continued. Per cent distribution of number by earnings—Continued. $12 to $15.	$15 to $20.	$20 to $25.	$25 and over	WOMEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over	CHILDREN UNDER 16 YEARS. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
18.4	13.7	3.0	0.7	$845	147	11.6	9.5	21.1	8.2	24.5	8.8	8.1	6.8	0.7	0.7		$592	190	46.3	25.3	18.9	4.2	3.2	1.6	0.5	1
16.5	11.8	2.0	0.3	100	21	9.5	4.8	66.7		4.8	9.5	4.7					54	19	47.4	36.8	15.8					2
15.8	5.3	2.6																								3
17.5	10.1	0.5	0.5	4	1			100.0																		4
18.3	14.0	2.8	0.3	84	17	5.9	5.9	64.7		5.9	11.7	5.9					18	6	50.0	16.7	33.3					5
8.0	7.6																									6
14.4	9.1	1.3	0.3	12	3	33.3		66.7									36	13	46.1	46.2	7.7					7
6.2	3.9	0.4		3	1	100.0											131	66	80.3	19.7						8
6.4	3.5	0.6																								9
20.0	1.3																8	2		100.0						10
4.7	4.2	0.4		3	1	100.0											123	64	82.8	17.2						11
19.3	14.5	3.2	0.7	710	119	11.8	9.2	14.3	10.1	26.1	9.2	9.3	8.4	0.8	0.8		318	74	13.5	29.7	32.4	10.8	8.1	4.1	1.4	12
17.7	12.4	3.5	0.4	346	50		6.0	20.0	14.0	28.0	10.0	16.0	4.0		2.0		3	1		100.0						13
17.2	12.8	2.6	1.2	10	3	66.7			33.3								14	5	100.0							14
21.3	18.3	4.0	0.9	281	54	22.2	14.8	11.1	7.4	14.8	7.4	5.6	14.8	1.9			18	4		50.0	25.0	25.0				15
26.4	8.1	1.8	0.6	6	1					100.0							60	17		70.6	23.5	5.9				16
15.2	16.4	3.0	0.7	62	10					80.0	20.0						199	38	2.6	7.9	47.4	15.8	15.8	7.9	2.6	17
22.5	12.5																									18
10.9	10.5	1.9		5	1			100.0									20	8	50.0	50.0						19
12.5	8.0	2.6	2.2																							20
14.6	13.9																4	1			100.0					21
8.1	4.6	1.8	0.9	24	4					100.0							72	27	59.3	22.2	18.5					22
7.3	4.0	1.7	0.8	24	4					100.0							72	27	59.3	22.2	18.5					23
16.7	9.7	2.8	1.4																							24
36.3	31.2	8.4	1.6														17	4			100.0					25
36.3	31.2	8.4	1.6														17	4			100.0					26
15.8	5.9	1.0	0.5	8	2		100.0																			27

BOOTS AND SHOES.

19.6	18.3	5.1	1.9	$229,468	30,195	4.6	6.8	9.3	11.6	12.2	12.4	10.5	9.9	11.8	7.9	3.0	$9,493	2,665	32.3	30.9	24.2	7.7	3.9	0.6	0.4	1
20.3	18.8	5.5	2.1	188,439	23,878	3.9	5.0	8.3	10.7	12.3	12.7	11.0	10.8	13.0	8.9	3.4	5,380	1,436	25.7	32.5	24.8	10.2	5.4	0.9	0.5	2
22.5	13.1	3.1	1.7	4,340	553	2.7	5.4	9.9	9.8	15.6	11.0	11.8	10.3	15.6	6.3	1.6	4	2	100.0							3
19.4	10.0	2.8	0.4	12,164	1,664	5.9	5.8	9.8	11.9	12.7	13.6	11.2	10.7	10.9	5.9	1.6	357	83	1.2	35.0	44.6	10.8	6.0	2.4		4
21.3	21.7	6.2	2.4	148,219	17,948	3.1	3.8	6.7	9.8	11.8	12.8	11.3	11.8	14.4	10.3	4.2	3,749	935	18.1	30.6	29.1	13.2	7.2	1.2	0.6	5
7.0	3.5	10.5	1.8	108	16	18.8	6.3	6.2		25.0	18.8	12.5			6.2	6.2										6
16.3	9.7	4.1	1.6	15,746	2,241	4.3	7.7	12.5	12.8	15.0	13.1	12.4	6.7	8.9	5.2	1.4	414	137	46.0	38.0	10.9	4.4	0.7			7
22.3	14.6	3.1	0.4	2,270	351	1.1	9.1	19.4	18.5	12.0	9.1	9.1	10.0	5.7	6.0		127	39	12.8	71.8	10.2	2.6	2.6			8
11.6	6.3	1.2	0.5	5,592	1,105	14.8	16.4	18.5	17.5	12.7	9.3	4.5	2.2	3.5	0.6		729	240	53.8	30.0	11.7	2.9	1.2		0.4	9
14.4	4.5	6.0	1.0	764	129	6.2	13.2	17.9	18.6	11.6	8.5	18.6	2.3	2.3	0.8		52	20	55.0	35.0	10.0					10
15.0	4.7	6.2	1.0	764	129	6.2	13.2	17.9	18.6	11.6	8.5	18.6	2.3	2.3	0.8		51	19	52.6	36.9	10.5					11
																	1	1	100.0							12
16.3	16.1	3.5	1.0	37,625	5,767	7.0	13.4	12.8	15.5	11.9	11.4	8.6	6.7	7.3	4.3	1.1	3,735	1,090	37.9	27.5	26.1	5.4	2.6	0.2	0.3	13
14.5	14.4	3.3	0.9	21,240	3,447	8.2	14.5	14.4	17.6	12.4	11.2	8.0	6.2	4.5	2.5	0.5	1,536	472	57.6	22.5	10.0	3.4	5.5	0.4	0.6	14
10.9	9.8	1.7		409	76	5.3	23.7	10.5	13.2	18.4	13.2	5.3	5.2	5.2			28	11	90.9	9.1						15
17.8	11.3	3.0	0.5	2,164	339	11.2	15.1	14.2	8.6	9.1	10.0	6.5	9.7	9.1	5.0	1.5	164	62	62.9	35.5		1.6				16
22.8	12.7	1.4	0.3	1,113	182	3.3	19.8	14.3	15.9	13.7	8.2	3.9	11.0	5.5	2.8	1.6	62	18	5.5	77.8	16.7					17
17.7	9.9	3.1	3.1	992	156	4.5	14.7	8.3	25.6	14.8	9.0	12.8	5.8	1.3	3.2		143	36	19.4	38.9	30.6	5.6	5.5			18
19.7	19.5	2.3		2,331	327	3.7	14.7	11.9	10.4	10.1	8.9	8.0	7.6	15.0	7.3	2.4	36	12	58.3	41.7						19
19.6	14.0	1.0	2.8	401	67	11.9	19.4	11.9	9.0	11.9	6.0	9.0	8.9	4.5	6.0	1.5	12	4	50.0	25.0	25.0					20
18.2	22.9	5.5	1.6	8,975	1,173	4.0	7.3	8.6	11.6	10.6	14.2	11.5	6.7	14.1	9.0	2.4	1,754	475	15.8	28.8	47.0	8.4				21
13.6	9.1	2.3		5	1				100.0								8	3	33.3	66.7						22
4.3				5	1				100.0								2	1	100.0							23
23.8	19.0	4.7															6	2		100.0						24
14.6	30.3	8.6	0.3	869	108		3.7	10.2	5.6	18.5	14.8	2.8	20.4	13.0	9.2	1.8	8	2			100.0					25
	50.0	33.3																								26
12.0	30.1	9.2	0.3	869	108		3.7	10.2	5.6	18.5	14.8	2.8	20.4	13.0	9.2	1.8	8	2			100.0					27
11.7	8.9	1.5	0.4	1,766	312	9.3	17.3	19.5	13.5	10.9	10.9	3.5	5.1	7.4	2.6		310	114	58.8	41.2						28

[2] Includes Delaware, 1; Georgia, 2; Indian Territory, 1; Kentucky, 2; Nebraska, 1; Oregon, 2; Rhode Island, 1; Utah, 1; Vermont, 1; Virginia, 2.

TABLE 71.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE SELECTED INDUSTRIES, BY STATES, TERRITO-
CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND AVERAGE WEEKLY EARNINGS, AND NUMBER

CARRIAGES AND WAGONS.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS.				TOTAL.		MEN 16 YEARS AND OVER.										
			All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Earnings.	Number.	Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	3,433	$10.69	$10.83	$5.85	$3.53	$448,841	41,978	$443,854	40,981	1.6	1.7	2.6	3.0	5.6	7.6	6.7	15.4	16.3
2	North Atlantic division	1,441	11.78	11.85	6.01	3.02	155,245	13,181	154,568	13,043	0.7	1.1	1.4	1.8	4.1	5.2	4.7	10.5	17.8
3	Maine	105	10.42	10.42	......	......	3,604	346	3,604	346	0.6	0.3	......	1.7	6.4	9.8	3.2	25.7	12.7
4	New Hampshire	25	11.60	11.60	......	......	1,682	145	1,682	145	......	2.1	......	1.4	2.8	5.5	3.4	14.5	14.5
5	Vermont	21	10.28	10.28	......	......	915	89	915	89	......	1.1	2.2	3.4	4.5	5.6	4.5	21.4	15.7
6	Massachusetts	254	12.51	12.55	7.00	5.00	31,699	2,534	31,582	2,517	0.1	0.3	0.4	1.3	2.6	2.3	2.6	6.8	17.7
7	Rhode Island	21	11.96	12.04	7.00	......	2,249	188	2,228	185	0.5	1.1	0.5	1.1	1.1	2.7	5.4	8.6	16.8
8	Connecticut	58	13.91	13.96	6.50	......	9,643	693	9,617	689	......	0.2	0.4	0.7	2.2	3.3	2.0	5.2	15.7
9	New York	396	11.88	11.97	5.90	3.00	55,284	4,652	54,950	4,589	1.2	1.2	1.4	1.7	3.2	3.9	4.8	10.4	21.0
10	New Jersey	155	12.02	12.05	5.00	3.00	13,210	1,099	13,196	1,095	0.2	0.3	0.8	1.2	4.1	3.3	5.0	11.9	16.6
11	Pennsylvania	406	10.76	10.86	4.92	2.97	36,959	3,435	36,794	3,388	0.9	2.2	2.7	3.0	6.8	9.6	7.0	12.1	15.0
12	South Atlantic division	358	8.36	8.57	6.56	3.18	26,689	3,191	26,199	3,056	2.9	5.9	9.1	8.1	11.6	11.0	7.8	10.1	9.8
13	Delaware	17	10.83	10.90	......	2.00	1,473	136	1,471	135	2.2	2.2	3.0	2.2	1.5	7.4	5.2	9.6	8.9
14	Maryland	85	9.52	9.56	......	2.33	5,637	592	5,630	589	2.2	3.2	3.7	3.9	10.0	10.0	8.7	12.9	14.3
15	District of Columbia	3	10.54	10.72	......	6.00	274	26	268	25	12.0	4.0	......	4.0	8.0	......	......	8.0	16.0
16	Virginia	59	8.11	8.51	......	2.68	4,469	551	4,367	513	3.1	7.2	11.3	10.1	13.5	8.2	5.5	8.0	6.4
17	West Virginia	26	10.57	10.57	......	......	1,839	174	1,839	174	0.6	0.6	1.2	6.9	10.3	8.6	6.3	10.3	10.3
18	North Carolina	78	7.06	7.30	4.20	3.43	6,268	888	6,065	831	3.9	4.7	13.2	12.9	12.3	14.8	11.2	9.7	6.7
19	South Carolina	27	6.77	6.95	7.33	2.58	1,868	276	1,793	258	5.0	12.0	17.8	10.1	12.8	7.8	6.2	8.5	7.0
20	Georgia	43	8.62	8.74	16.00	4.20	3,843	446	3,748	429	1.9	10.5	7.5	4.7	14.4	11.2	6.5	11.0	13.0
21	Florida	20	9.98	9.98	......	......	1,018	102	1,018	102	......	2.9	2.9	4.9	7.9	17.7	2.9	8.8	18.6
22	North Central division	1,236	10.35	10.49	5.84	4.17	222,952	21,546	219,470	20,915	1.9	1.4	2.2	2.6	4.9	7.7	7.8	20.7	17.8
23	Ohio	224	10.62	10.77	5.89	3.67	43,597	4,105	42,891	3,984	0.8	2.1	3.1	3.2	5.3	7.9	9.3	15.5	16.0
24	Indiana	139	9.59	9.80	5.65	4.34	70,311	7,334	68,510	6,994	3.8	1.0	2.2	2.1	4.8	7.8	7.6	29.4	17.2
25	Illinois	198	11.54	11.65	5.15	3.93	29,788	2,581	29,594	2,540	0.7	1.1	2.4	3.1	3.6	5.2	7.3	11.7	20.2
26	Michigan	136	10.25	10.35	6.64	3.00	35,263	3,439	34,702	3,354	0.8	1.6	1.9	1.9	4.9	9.3	9.3	20.5	19.3
27	Wisconsin	190	10.11	10.13	6.00	2.00	7,868	778	7,860	776	0.5	0.6	1.2	3.6	4.8	7.4	6.4	21.3	23.1
28	Minnesota	91	10.05	10.09	5.33	3.00	6,837	680	6,818	676	0.2	1.0	0.9	3.0	4.1	13.0	9.9	20.4	14.4
29	Iowa	69	10.23	10.30	5.50	......	5,565	544	5,521	536	0.7	1.3	1.7	4.3	10.6	5.6	4.1	23.5	15.9
30	Missouri	149	11.63	11.73	5.75	3.50	20,976	1,803	20,840	1,777	1.1	1.4	1.7	2.9	5.2	5.3	5.1	11.3	19.0
31	Nebraska	11	11.40	11.40	......	......	832	73	832	73	......	......	2.7	1.4	1.4	11.0	2.7	12.3	13.7
32	Kansas	29	9.16	9.28	3.00	3.33	1,915	209	1,902	205	5.4	4.9	3.4	3.9	7.8	10.7	2.4	18.1	10.7
33	South Central division	181	9.21	9.45	4.65	3.26	26,676	2,875	26,385	2,793	2.4	2.6	4.9	6.1	12.5	16.9	8.4	9.1	9.8
34	Kentucky	70	9.11	9.31	4.62	3.53	13,211	1,450	13,010	1,398	1.6	2.4	4.8	6.5	8.7	23.6	10.6	8.4	11.2
35	Tennessee	34	8.88	8.98	5.00	3.00	5,738	646	5,703	635	6.0	3.3	6.8	6.9	16.4	12.1	6.9	8.8	7.6
36	Alabama	9	8.94	9.30	......	3.00	2,521	282	2,473	266	......	1.5	4.1	10.1	20.3	10.9	7.5	8.6	11.7
37	Mississippi	7	8.68	8.76	......	2.00	738	85	736	84	......	1.2	......	1.2	35.7	13.1	1.2	22.6	1.2
38	Louisiana	25	10.72	10.81	......	2.50	1,983	185	1,978	183	......	3.8	4.9	0.6	9.8	8.8	2.2	14.2	8.7
39	Texas	23	12.48	12.48	......	......	1,547	124	1,547	124	......	......	3.2	......	5.7	4.0	8.9	4.8	10.5
40	Oklahoma	4	11.20	11.20	......	......	392	35	392	35	......	......	5.7	......	17.1	......	......	5.7	2.9
41	Arkansas	9	8.03	8.03	......	......	546	68	546	68	7.4	10.3	3.0	10.3	13.2	5.9	8.8	5.8	11.8
42	Western division	214	14.49	14.67	......	4.27	17,139	1,176	17,092	1,165	0.5	0.9	1.4	1.3	2.4	2.8	2.2	4.9	5.5
43	Montana	4	22.79	24.31	......	3.00	319	14	316	13	......	......	......	......	......	......	......	......	......
44	Colorado	30	14.64	15.08	......	4.00	2,256	154	2.232	148	......	......	......	1.3	1.4	2.7	1.4	2.0	4.7
45	Utah	3	14.45	14.45	......	......	159	11	159	11	......	......	......	18.2	......	......	......	18.2	9.1
46	Washington	16	15.76	15.76	......	......	2,001	127	2,001	127	......	......	3.1	0.8	0.8	0.8	2.4	4.7	3.9
47	Oregon	9	15.69	15.69	......	......	549	35	549	35	......	......	......	......	2.9	2.9	......	2.9	2.8
48	California	152	14.20	14.24	......	5.00	11,855	835	11,835	831	0.7	1.2	1.4	1.2	2.9	3.3	2.5	5.4	6.0
49	All other states	[1] 3	15.56	15.56	......	......	140	9	140	9	......	......	......	......	......	......	......	11.1	......

CLOTHING, MEN'S.

	STATE OR TERRITORY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	1,697	$8.50	$12.23	$6.07	$2.98	$402,605	47,344	$233,527	19,095	0.9	2.2	3.1	4.0	5.2	6.0	6.7	7.7	14.9
2	North Atlantic division	992	9.53	12.31	6.43	3.41	232,302	24,379	159,451	12,949	0.9	2.3	3.1	4.1	4.6	6.0	6.9	7.7	15.2
3	Maine	13	6.45	9.39	5.69	......	1,600	248	479	51	......	2.0	5.9	......	5.9	7.8	31.4	21.6	9.8
4	Vermont	3	5.30	8.31	4.87	......	1,669	315	324	39	7.7	5.1	7.7	2.6	7.7	17.9	5.1	10.3	20.5
5	Massachusetts	149	9.41	12.85	6.88	4.25	39,502	4,199	23,084	1,797	0.1	0.4	0.4	1.0	2.2	3.9	7.6	9.9	16.6
6	Connecticut	6	7.97	12.63	7.36	......	1,665	209	303	24	......	......	4.1	4.1	4.2	......	......	16.7	12.5
7	New York	657	9.83	12.30	6.47	3.36	158,798	16,162	115,189	9,362	1.1	2.8	3.9	4.8	5.2	6.4	6.4	6.8	14.4
8	New Jersey	36	7.73	11.81	5.64	3.00	6,186	800	3,237	274	0.4	1.5	1.1	2.5	2.5	10.6	7.7	14.6	15.0
9	Pennsylvania	128	9.35	12.01	5.95	2.95	22,882	2,446	16,835	1,402	0.7	1.3	1.4	3.5	4.2	5.0	8.3	8.9	18.8
10	South Atlantic division	73	8.21	11.91	5.47	2.57	25,993	3,166	16,490	1,384	0.4	2.5	4.0	3.5	4.1	5.9	6.8	7.9	18.1
11	Maryland	68	8.69	12.15	5.71	3.19	24,447	2,812	16,094	1,325	0.3	2.0	3.8	3.2	3.6	5.4	6.6	7.9	18.6
12	North Carolina	5	4.37	6.71	4.17	1.50	1,546	354	396	59	3.4	13.5	8.5	11.9	16.9	16.9	10.2	8.5	5.1

[1] Includes New Mexico, 1; North Dakota, 1; South Dakota, 1.

RIES, AND GEOGRAPHIC DIVISIONS—PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND OF ALL WAGE-EARNERS AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

CARRIAGES AND WAGONS.

MEN 16 YEARS AND OVER—continued. Per cent distribution of number by earnings—Continued.				WOMEN 16 YEARS AND OVER.													CHILDREN UNDER 16 YEARS									
				Earnings.	Number.	Per cent distribution of number by earnings.											Earnings.	Number.	Per cent distribution of number by earnings.							
$12 to $15.	$15 to $20.	$20 to $25.	$25 and over			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
21.6	15.2	2.2	0.5	$3,702	633	5.2	13.4	15.0	18.2	17.4	14.9	8.5	4.4	1.9	0.6	0.5	$1,285	364	34.0	26.4	23.9	12.9	2.2	0.3	0.3	1
27.5	21.9	2.6	0.7	523	87	5.8	9.2	8.0	26.4	19.5	5.8	12.6	10.3	1.2	1.2	.....	154	51	39.2	52.9	2.0	3.9	2.0	.....	.....	2
30.1	8.7	0.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3
36.5	19.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
31.5	10.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5
33.9	28.8	2.7	0.5	112	16	12.5	6.2	6.2	6.2	12.5	.....	6.3	43.8	6.3	.....	.....	5	1	.....	.....	.....	100.0	.....	.....	.....	6
37.8	23.3	1.1	.....	21	3	.....	.....	.....	.....	33.3	33.3	33.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7
31.2	33.0	3.8	2.3	26	4	.....	.....	25.0	25.0	.....	.....	50.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8
26.6	20.6	3.1	0.9	295	50	4.0	4.0	8.0	40.0	20.0	8.0	12.0	2.0	.....	2.0	.....	39	13	53.8	23.1	7.7	7.7	7.7	.....	.....	9
27.0	27.4	1.6	0.6	5	1	.....	.....	.....	100.0	.....	.....	.....	.....	.....	.....	.....	9	3	33.3	66.7	.....	.....	.....	.....	.....	10
22.0	16.2	2.2	0.3	64	13	7.6	38.5	7.7	.....	30.8	.....	7.7	7.7	.....	.....	.....	101	34	35.3	64.7	.....	.....	.....	.....	.....	11
15.3	7.3	0.8	0.3	118	18	.....	11.1	50.0	5.6	.....	16.7	.....	11.1	.....	.....	5.5	372	117	54.7	17.9	19.7	6.8	0.9	.....	.....	12
47.4	9.7	0.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	1	100.0	.....	.....	.....	.....	.....	.....	13
21.1	8.3	1.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7	3	66.7	33.3	.....	.....	.....	.....	.....	14
20.0	28.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	1	.....	.....	.....	.....	100.0	.....	.....	15
17.5	7.8	1.0	0.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	102	38	86.8	13.2	.....	.....	.....	.....	.....	16
27.6	14.4	0.6	2.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17
7.1	3.1	0.4	.....	42	10	.....	20.0	80.0	.....	.....	.....	.....	.....	.....	.....	.....	161	47	31.9	17.0	44.7	6.4	.....	.....	.....	18
7.4	5.4	.....	.....	44	6	.....	.....	16.7	16.7	.....	33.3	.....	33.3	.....	.....	.....	31	12	75.0	25.0	.....	.....	.....	.....	.....	19
9.8	7.4	1.2	0.9	32	2	.....	.....	.....	.....	.....	50.0	.....	.....	.....	.....	50.0	63	15	26.7	26.7	13.3	33.3	.....	.....	.....	20
15.7	17.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	21
19.8	11.1	1.7	0.4	2,982	511	5.5	14.1	14.5	16.0	18.2	16.8	8.4	3.3	2.2	0.6	0.4	500	120	11.7	22.5	37.5	24.2	2.5	0.8	0.8	22
21.7	12.5	1.8	0.8	605	118	3.4	12.7	16.1	15.3	18.6	21.2	6.8	4.2	0.9	.....	0.8	11	3	.....	66.7	.....	33.3	.....	.....	.....	23
15.6	7.0	1.3	0.2	1,406	249	7.2	15.7	14.1	17.7	18.5	14.0	8.0	2.0	2.4	.....	0.4	395	91	6.6	20.9	36.2	30.8	3.3	1.1	1.1	24
23.6	17.8	2.8	0.5	139	27	3.7	18.5	29.7	14.8	11.1	11.1	7.4	3.7	.....	.....	.....	55	14	21.4	7.2	71.4	.....	.....	.....	.....	25
20.1	8.7	1.5	0.2	558	84	4.8	9.5	13.1	9.5	13.1	22.6	13.1	5.9	4.8	3.6	.....	3	1	100.0	.....	.....	.....	.....	.....	.....	26
24.1	6.4	0.6	.....	6	1	.....	.....	.....	.....	100.0	.....	.....	.....	.....	.....	.....	2	1	100.0	.....	.....	.....	.....	.....	.....	27
21.3	11.2	0.6	.....	16	3	.....	.....	.....	66.7	33.3	.....	.....	.....	.....	.....	.....	3	1	100.0	.....	.....	.....	.....	.....	.....	28
21.3	9.5	1.3	0.2	44	8	.....	12.5	12.5	12.5	62.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	29
22.2	20.3	3.4	1.1	115	20	5.0	15.0	.....	25.0	20.0	20.0	10.0	5.0	.....	.....	.....	21	6	.....	83.3	16.7	.....	.....	.....	.....	30
28.8	26.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	31
22.9	9.8	.....	.....	3	1	.....	100.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	10	3	66.7	.....	33.3	.....	.....	.....	.....	32
15.0	10.4	1.2	0.7	79	17	.....	17.7	29.4	52.9	.....	.....	.....	.....	.....	.....	.....	212	65	40.0	26.2	24.6	7.7	1.5	.....	.....	33
13.7	6.9	0.8	0.8	74	16	.....	18.8	31.2	50.0	.....	.....	.....	.....	.....	.....	.....	127	36	38.9	8.3	38.9	13.9	.....	.....	.....	34
12.1	9.6	2.2	1.3	5	1	.....	.....	.....	100.0	.....	.....	.....	.....	.....	.....	.....	30	10	20.0	70.0	.....	.....	10.0	.....	.....	35
13.2	11.3	0.4	0.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	48	16	50.0	37.5	12.5	.....	.....	.....	.....	36
11.9	11.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	1	100.0	.....	.....	.....	.....	.....	.....	37
23.5	21.9	1.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	2	50.0	50.0	.....	.....	.....	.....	.....	38
27.4	32.3	3.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39
42.9	25.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	40
19.1	4.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	41
20.0	44.6	12.4	1.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	47	11	.....	36.3	18.2	27.3	18.2	.....	.....	42
.....	23.1	38.5	38.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	1	.....	100.0	.....	.....	.....	.....	.....	43
23.6	45.3	16.9	0.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	24	6	.....	33.3	33.3	33.4	.....	.....	.....	44
.....	27.2	18.2	9.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45
21.3	43.3	17.3	1.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	46
17.1	54.3	17.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	47
19.9	44.9	10.2	0.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	20	4	.....	25.0	.....	25.0	50.0	.....	.....	48
.....	88.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	49

CLOTHING, MEN'S.

18.2	19.2	9.3	2.6	$166,801	27,485	8.3	10.3	13.4	17.5	17.7	11.6	8.1	5.9	4.7	1.9	0.6	$2,277	764	51.6	31.1	12.3	2.6	1.7	0.7	.....	1
17.8	18.9	9.7	2.8	72,118	11,215	6.2	8.8	12.0	17.4	17.5	12.7	9.5	7.1	5.5	2.3	1.0	733	215	35.4	35.4	18.1	5.1	3.7	2.3	.....	2
9.8	1.9	3.9	.....	1,121	197	3.5	4.6	10.7	45.2	19.3	5.6	8.1	1.0	1.0	1.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3
5.1	10.3	.....	.....	1,345	276	21.4	17.0	16.3	12.7	13.0	8.3	6.5	1.5	2.6	0.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
23.0	23.8	9.7	1.4	16,248	2,362	3.8	4.8	9.4	18.8	19.7	13.1	11.9	8.2	6.6	2.4	1.3	170	40	12.5	20.0	32.5	15.0	15.0	5.0	.....	5
4.2	54.2	.....	.....	1,362	185	.....	0.5	10.8	10.3	11.4	15.7	16.2	25.9	7.6	1.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6
16.5	17.7	10.6	3.4	43,226	6,686	6.2	9.2	12.5	16.0	17.3	12.9	9.2	7.0	5.8	2.7	1.2	383	114	33.3	43.0	15.8	3.5	1.8	2.6	.....	7
16.4	13.9	11.3	2.5	2,931	520	13.3	12.7	12.1	16.2	17.5	11.5	6.7	6.3	3.5	0.2	.....	18	6	66.7	33.3	.....	.....	.....	.....	.....	8
20.3	21.8	4.6	1.2	5,885	989	6.1	13.1	13.7	20.6	16.1	13.1	7.3	5.1	3.5	1.0	0.4	162	55	52.7	30.9	14.6	1.8	.....	.....	.....	9
19.7	22.5	3.5	1.1	9,292	1,700	15.3	15.2	16.1	13.5	15.7	7.2	8.2	5.8	2.4	0.5	0.1	211	82	67.1	28.0	3.7	.....	1.2	.....	.....	10
20.5	23.3	3.7	1.1	8,187	1,435	14.3	12.5	14.8	14.5	16.7	7.7	9.4	6.6	2.8	0.6	0.1	166	52	48.1	44.2	5.8	.....	1.9	.....	.....	11
1.7	3.4	.....	.....	1,105	265	20.4	29.8	23.4	7.9	9.8	4.9	1.9	1.5	0.4	.....	.....	45	30	100.0	.....	.....	.....	.....	.....	.....	12

TABLE 71.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE SELECTED INDUSTRIES, BY STATES, TERRITO- CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND AVERAGE WEEKLY EARNINGS, AND NUMBER

CLOTHING, MEN'S—Continued.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
13	North Central division	496	$7.72	$12.58	$5.96	$3.13	$109,095	14,124	$48,737	3,874	0.7	1.1	2.2	3.2	5.1	5.2	5.5	7.3	14.3
14	Ohio	223	7.77	11.96	5.65	3.00	30,301	3,901	15,978	1,336	1.4	1.6	2.3	3.9	5.7	5.3	5.6	8.7	14.0
15	Indiana	17	5.54	9.21	5.26	2.64	7,015	1,267	958	104	1.0	2.9	7.7	7.7	6.7	6.7	7.7	16.3	13.5
16	Illinois	177	9.27	13.33	6.73	3.34	43,914	4,739	25,447	1,909	0.1	0.5	1.5	2.7	5.1	4.8	5.4	5.3	14.1
17	Michigan	21	6.49	11.42	5.89	......	10,268	1,582	1,976	173	0.6	0.6	4.0	1.7	4.6	8.1	6.4	11.6	22.0
18	Wisconsin	23	5.95	9.03	5.35	......	1,326	223	325	36	5.6	8.3	5.6	5.6	2.8	5.5	8.3	16.7	19.4
19	Minnesota	10	6.38	10.93	5.79	......	3,347	525	656	60	1.7	......	11.6	3.3	1.7	8.3	6.7	10.0	13.3
20	Iowa	4	5.33	9.04	5.07	2.00	1,595	299	244	27	3.7	7.4	7.4	3.7	7.4	3.7	11.1	3.7	33.4
21	Missouri	21	7.13	13.77	6.05	2.57	11,329	1,588	3,153	229	0.4	0.9	0.9	1.8	3.1	3.9	2.6	7.0	10.0
22	South Central division	80	5.70	9.64	5.03	2.41	19,540	3,428	5,639	585	3.6	6.2	6.0	7.4	10.9	9.9	10.1	8.2	9.7
23	Kentucky	54	6.06	9.92	5.14	2.55	13,627	2,248	4,661	470	3.0	5.3	4.4	6.6	11.1	10.0	11.1	9.1	10.4
24	Tennessee	8	4.50	8.11	4.28	2.31	3,291	731	714	88	8.0	10.2	14.8	9.1	12.5	6.8	6.8	5.7	4.5
25	Louisiana	9	5.76	9.00	4.42	......	392	68	180	20	......	10.0	5.0	15.0	......	20.0	......	......	20.0
26	Texas	9	5.85	12.00	5.74	......	2,230	381	84	7	......	......	......	14.3	14.3	14.3	14.3	......	......
27	Western division	40	8.29	11.66	7.57	3.67	9,016	1,088	2,250	193	0.5	1.0	1.0	3.6	25.9	13.5	11.9	7.8	2.1
28	Washington	3	6.83	11.20	6.31	......	321	47	56	5	......	......	20.0	......	......	20.0	......	......	......
29	Oregon	3	8.56	11.75	8.30	......	3,201	374	329	28	......	......	......	......	10.7	3.6	57.1	3.6	3.6
30	California	34	8.24	11.66	7.18	3.67	5,494	667	1,865	160	0.6	1.2	0.6	4.4	29.4	15.0	4.4	8.8	1.8
31	All other states	[1] 16	5.75	8.73	5.53	2.66	6,659	1,159	960	110	1.8	5.5	6.4	10.0	18.2	6.4	5.4	5.4	21.8

CLOTHING, WOMEN'S.

	STATE OR TERRITORY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	1,072	$9.01	$13.52	$6.85	$3.49	$363,135	40,312	$178,577	13,205	0.6	1.2	1.6	2.9	4.1	5.3	7.1	8.8	15.3
2	North Atlantic division	793	9.51	13.58	7.24	3.54	296,158	31,135	154,113	11,346	0.5	1.1	1.4	2.7	3.7	5.0	7.3	9.0	15.8
3	Vermont	4	6.89	14.00	6.52	2.00	937	136	112	8	......	......	......	......	......	......	......	......	50.0
4	Massachusetts	126	7.90	12.65	6.79	4.10	43,584	5,516	13,537	1,070	0.4	0.8	1.0	2.4	2.2	4.4	6.5	11.5	19.5
5	Connecticut	10	6.12	9.83	5.89	3.91	4,788	782	845	86	1.2	1.1	10.4	5.8	10.5	8.1	10.5	7.0	19.8
6	New York	551	10.31	13.67	7.68	3.44	222,133	21,555	130,276	9,532	0.5	1.2	1.4	2.7	3.8	5.0	6.8	8.9	15.0
7	New Jersey	25	6.28	11.19	5.93	3.20	6,843	1,090	1,074	96	2.1	......	......	1.0	4.2	1.0	34.4	4.2	27.1
8	Pennsylvania	77	8.69	14.93	6.47	2.23	17,873	2,056	8,269	554	......	0.4	1.6	3.8	4.5	6.3	11.2	8.1	18.9
9	South Atlantic division	31	6.67	13.45	5.11	2.50	9,847	1,477	3,739	278	0.7	0.7	0.7	2.2	3.3	6.5	5.4	10.4	11.9
10	Maryland	31	6.67	13.45	5.11	2.50	9,847	1,477	3,739	278	0.7	0.7	0.7	2.2	3.3	6.5	5.4	10.4	11.9
11	North Central division	189	7.53	13.34	6.04	3.34	49,336	6,554	18,090	1,356	0.8	1.6	3.1	4.4	7.0	7.1	5.5	6.8	12.4
12	Ohio	69	7.34	11.27	5.70	2.25	14,084	1,918	6,392	567	0.4	0.7	5.0	7.4	10.6	10.4	5.8	9.0	12.5
13	Indiana	12	6.31	13.36	5.61	3.50	3,965	628	788	59	......	6.8	5.1	8.5	......	1.7	5.1	3.4	16.9
14	Illinois	59	10.40	17.90	7.33	3.41	14,417	1,386	7,320	409	0.5	1.0	1.2	0.7	3.2	2.4	3.7	2.9	7.3
15	Michigan	29	6.07	9.74	5.62	3.44	10,415	1,715	1,870	192	3.6	4.2	2.6	5.2	10.4	12.0	8.9	7.3	17.7
16	Wisconsin	7	6.11	12.63	5.38	......	1,160	190	240	19	......	5.3	......	......	......	5.3	15.8	15.8	21.0
17	Missouri	13	7.38	13.45	6.33	3.44	5,295	717	1,480	110	......	......	0.9	......	1.8	1.8	3.6	9.1	17.3
18	South Central division	10	6.42	11.73	5.48	......	2,183	340	598	51	5.9	2.0	......	2.0	9.8	2.0	9.8	9.8	17.6
19	Kentucky	7	7.00	12.14	6.09	......	1,630	233	425	35	......	......	......	......	2.9	2.8	11.4	14.3	22.9
20	Tennessee	3	5.17	10.81	4.18	......	553	107	173	16	18.8	6.3	......	6.2	25.0	......	6.3	......	6.2
21	Western division	28	9.69	13.25	7.37	......	3,051	315	1,643	124	......	......	......	0.8	3.2	12.1	12.1	9.7	11.3
22	Washington	3	11.40	11.40	......	......	114	10	114	10	......	......	......	......	......	10.0	......	......	40.0
23	California	25	9.63	13.41	7.37	......	2,937	305	1,529	114	......	......	......	0.9	3.5	12.3	13.1	10.5	8.8
24	All other states	[2] 21	5.20	7.88	4.92	2.00	2,560	491	394	50	12.0	14.0	6.0	8.0	10.0	10.0	......	6.0	20.0

COTTON GOODS.

	STATE OR TERRITORY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	525	$6.47	$7.71	$6.03	$3.21	$1,307,578	202,211	$732,305	95,025	4.1	5.4	10.3	11.4	15.0	13.5	9.7	8.9	10.0
2	North Atlantic division	262	7.51	8.71	6.72	4.15	1,002,128	133,361	561,577	64,475	1.3	2.1	4.5	8.8	14.9	15.9	12.2	10.9	13.7
3	Maine	7	6.88	8.16	6.15	2.49	32,080	4,666	16,544	2,028	2.3	5.7	5.0	6.7	14.8	13.0	11.0	12.0	17.4
4	New Hampshire	5	7.80	8.67	7.05	4.18	78,894	10,117	43,302	4,993	1.7	1.8	3.8	6.8	14.8	17.5	13.3	11.9	16.1
5	Massachusetts	109	7.47	8.53	6.79	4.42	637,975	85,353	352,647	41,320	1.4	1.8	4.4	9.5	16.0	16.6	12.3	10.6	13.1
6	Rhode Island	42	7.19	8.42	6.44	3.61	99,572	13,854	58,778	6,978	0.5	2.4	5.8	7.6	14.4	18.2	13.2	10.9	14.5
7	Connecticut	20	7.36	8.26	6.71	4.02	55,201	7,499	33,233	4,023	1.9	2.4	4.7	11.6	14.3	13.8	12.6	12.4	14.7
8	New York	9	7.17	7.92	6.33	4.17	9,539	1,330	6,264	791	0.1	8.1	11.5	16.7	11.8	12.4	6.8	6.7	7.3
9	New Jersey	10	7.94	11.01	6.69	3.76	25,052	3,154	12,296	1,117	0.5	0.8	2.8	5.2	8.9	11.7	5.4	9.6	13.1
10	Pennsylvania	60	8.64	11.94	6.52	3.58	63,815	7,388	38,513	3,225	1.1	1.4	3.1	3.5	6.0	7.2	9.8	11.4	13.8
11	South Atlantic division	215	4.33	5.45	3.99	2.69	244,857	56,494	138,984	25,484	10.8	12.6	22.7	17.4	15.2	7.9	4.2	4.4	2.0
12	Maryland	4	5.44	7.86	5.07	2.62	15,235	2,799	6,968	886	2.4	7.9	13.7	3.6	14.2	17.1	5.2	11.9	12.0
13	North Carolina	106	4.19	5.33	3.82	2.64	87,220	20,830	48,087	9,023	8.3	12.8	25.9	17.5	18.3	7.0	3.7	3.6	1.3
14	South Carolina	62	4.21	5.15	3.83	2.80	88,048	20,933	51,685	10,038	12.4	14.2	22.6	18.9	13.2	7.6	4.4	3.8	1.1
15	Georgia	43	4.56	5.82	4.17	2.62	54,354	11,932	32,244	5,537	13.1	10.4	19.0	16.7	14.1	8.2	4.7	5.5	3.0

[1] Includes Alabama, 1; Colorado, 1; Delaware, 1; Georgia, 2; Kansas, 2; Nebraska, 2; New Hampshire, 2; South Carolina, 1; Virginia, 2; West Virginia, 2.
[2] Includes Colorado, 1; District of Columbia, 1; Georgia, 1; Idaho, 1; Iowa, 2; Kansas, 1; Louisiana, 2; Maine, 2; Nebraska, 1; North Carolina, 2; Rhode Island, 1; South Carolina, 2, Texas, 1; Virginia, 1; West Virginia, 2.

RIES, AND GEOGRAPHIC DIVISIONS—PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND OF ALL WAGE-EARNERS AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

CLOTHING, MEN'S—Continued.

MEN 16 YEARS AND OVER—continued. Per cent distribution of number by earnings—Continued. $12 to $15.	$15 to $20.	$20 to $25.	$25 and over	WOMEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over	CHILDREN UNDER 16 YEARS. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
21.1	21.6	10.5	2.2	$59,508	9,978	7.9	9.3	13.7	18.8	19.7	11.7	7.4	4.9	4.5	1.8	0.3	$850	272	38.2	39.0	18.4	2.9	1.5	.....	.....	13
22.5	18.3	8.5	2.2	14,143	2,505	6.9	12.1	16.0	21.4	18.8	11.1	6.8	3.6	2.1	1.1	0.1	180	60	48.3	36.7	11.6	1.7	1.7	.....	.....	14
16.4	11.5	1.9	.....	5,999	1,141	15.1	11.5	13.2	24.3	19.4	7.8	4.4	2.2	0.9	1.2	.....	58	22	72.7	18.2	4.5	.....	4.6	.....	.....	15
20.2	24.2	13.5	2.6	17,909	2,663	4.8	6.7	8.9	15.1	15.9	15.5	10.6	9.1	8.7	3.9	0.8	558	167	22.8	46.7	25.1	4.2	1.2	.....	.....	16
17.3	17.3	4.6	1.2	8,292	1,409	9.8	9.4	15.0	13.0	27.0	10.1	7.9	2.7	4.4	0.6	0.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	17
11.1	11.1	.....	.....	1,001	187	10.7	9.1	24.6	24.1	13.4	6.4	4.8	3.7	1.6	1.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18
31.7	6.7	1.7	3.3	2,691	465	10.5	8.4	17.6	17.2	14.8	14.2	5.4	6.2	3.5	2.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	19
7.4	11.1	.....	.....	1,333	263	15.2	22.0	17.5	13.7	14.1	5.7	3.8	2.3	4.2	1.1	0.4	18	9	100.0	.....	.....	.....	.....	.....	.....	20
25.3	34.1	9.6	0.4	8,140	1,345	5.1	4.8	14.8	23.2	25.0	11.5	5.6	3.9	5.0	1.1	.....	36	14	85.7	14.3	.....	.....	.....	.....	.....	21
12.1	8.7	4.8	2.4	13,522	2,686	14.3	16.6	17.8	17.3	15.3	8.6	4.2	3.7	1.2	0.6	0.4	379	157	83.5	15.9	.....	0.6	.....	.....	.....	22
13.0	7.9	5.1	3.0	8,790	1,709	13.4	13.9	19.7	19.2	13.0	10.0	4.2	4.7	1.2	0.3	0.4	176	[illegible]	66.7	31.9	.....	1.4	.....	.....	.....	23
6.8	11.4	3.4	.....	2,374	555	17.5	30.3	19.3	13.9	9.2	4.1	3.2	1.6	0.7	0.2	.....	203	88	96.6	3.4	.....	.....	.....	.....	.....	24
20.0	10.0	.....	.....	212	48	29.2	12.5	14.6	31.2	8.3	4.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	25
.....	28.5	14.3	.....	2,146	374	11.5	9.6	6.9	12.3	35.6	9.4	5.9	2.9	2.4	2.4	1.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	26
6.2	9.3	12.5	4.7	6,755	592	3.8	5.2	7.3	11.4	15.9	17.4	11.7	9.7	11.8	4.8	1.0	11	3	.....	33.3	66.7	.....	.....	.....	.....	27
20.0	40.0	.....	.....	265	42	9.5	7.1	7.1	16.7	14.3	19.1	4.8	14.3	7.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28
.....	3.6	14.3	3.5	2,872	346	4.3	3.5	2.3	5.5	18.8	21.1	11.3	14.4	12.4	6.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	29
6.9	9.4	12.5	5.0	3,618	504	3.0	6.1	10.7	15.1	14.1	14.7	12.5	6.1	11.7	4.2	1.8	11	3	.....	33.3	66.7	.....	.....	.....	.....	30
9.1	6.4	2.7	0.9	5,606	1,014	10.8	17.8	14.8	19.4	12.0	7.6	7.4	4.2	4.0	1.2	0.8	93	35	80.0	20.0	.....	.....	.....	.....	.....	31

CLOTHING, WOMEN'S.

19.1	18.3	9.2	6.5	$183,259	26,735	6.1	8.4	11.6	13.5	15.7	12.5	10.5	7.4	7.8	4.3	2.2	$1,299	372	28.8	36.6	22.3	11.5	0.8	.....	.....	1
19.0	18.7	9.4	6.4	140,920	19,471	4.5	6.8	10.2	13.0	15.4	13.7	11.0	8.4	9.1	5.1	2.8	1,125	318	28.0	36.8	22.0	12.6	0.6	.....	.....	2
12.5	25.0	12.5	.....	821	126	8.7	7.1	7.1	4.0	2.4	39.7	18.3	12.7	.....	.....	.....	4	2	100.0	.....	.....	.....	.....	.....	.....	3
26.4	18.8	5.0	1.1	29,801	4,386	3.5	6.0	10.7	13.8	18.4	15.1	13.4	7.4	8.0	3.1	0.6	246	60	5.0	45.0	30.0	16.7	3.3	.....	.....	4
12.8	10.5	1.1	1.2	3,638	618	10.7	7.8	20.9	19.7	12.8	18.6	3.7	1.6	3.4	0.8	.....	305	78	11.5	39.8	33.3	15.4	.....	.....	.....	5
18.7	19.1	10.2	6.7	91,489	11,916	4.0	6.5	8.9	11.8	13.7	13.0	10.9	9.6	10.8	6.8	4.0	368	107	20.6	50.4	24.3	4.7	.....	.....	.....	6
3.1	15.6	7.3	.....	5,625	949	9.1	9.9	12.3	16.3	19.8	13.2	8.6	4.7	3.3	1.9	0.9	144	45	66.7	4.4	.....	28.9	.....	.....	.....	7
14.3	13.0	4.9	13.0	9,546	1,476	5.1	9.0	13.2	17.0	20.0	10.8	8.3	6.6	5.4	2.8	1.8	58	26	88.5	11.5	.....	.....	.....	.....	.....	8
27.7	15.1	8.6	6.8	6,093	1,193	19.8	16.5	14.7	16.2	11.5	7.4	5.3	3.5	2.9	1.6	0.6	15	6	66.6	16.7	16.7	.....	.....	.....	.....	9
27.7	15.1	8.6	6.8	6,093	1,193	19.8	16.5	14.7	16.2	11.5	7.4	5.3	3.5	2.9	1.6	0.6	15	[illegible]	66.6	16.7	16.7	.....	.....	.....	.....	10
18.5	17.1	7.7	8.0	31,089	5,151	6.8	12.2	16.5	14.3	18.3	9.5	10.3	4.5	4.3	2.3	1.0	157	47	27.7	38.3	25.5	6.4	2.1	.....	.....	11
17.6	13.9	2.5	4.2	7,683	1,347	10.3	13.7	18.9	13.7	12.6	10.0	8.5	4.9	4.2	2.1	1.1	[illegible]	4	100.0	.....	.....	.....	.....	.....	.....	12
16.9	18.6	11.9	5.1	3,149	561	9.8	17.6	17.5	18.2	9.8	7.3	6.1	4.8	4.6	2.5	1.8	28	8	37.5	37.5	.....	25.0	.....	.....	.....	13
17.6	24.5	16.4	18.6	7,039	960	4.4	5.7	8.8	14.8	18.6	13.2	9.3	7.6	9.5	5.8	2.3	58	17	29.4	23.5	35.3	5.9	5.9	.....	.....	14
16.2	8.3	3.1	0.5	8,514	1,514	3.9	15.1	20.5	12.8	22.6	6.7	13.7	1.9	2.2	0.6	.....	31	9	.....	66.7	33.3	.....	.....	.....	.....	15
.....	26.3	5.2	5.3	920	171	15.8	15.2	17.6	14.0	8.2	2.3	18.1	8.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16
34.6	19.1	9.1	2.7	3,784	598	4.5	5.7	12.4	15.2	30.8	13.0	9.5	4.2	2.3	1.7	0.7	31	9	11.1	55.6	33.3	.....	.....	.....	.....	17
13.7	17.6	3.9	5.9	1,585	289	20.8	9.7	11.8	11.4	15.2	8.3	9.3	7.6	5.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18
20.0	20.0	2.8	2.9	1,205	198	11.6	9.1	7.1	10.6	20.2	10.6	11.6	11.1	8.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	19
.....	12.5	6.2	12.5	380	91	40.6	11.0	22.0	13.2	4.4	3.3	4.4	.....	1.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	20
18.5	12.1	18.6	1.6	1,408	191	2.6	3.1	3.7	22.0	15.2	12.0	13.1	10.5	10.5	6.3	1.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	21
50.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	22
15.8	13.2	20.2	1.7	1,408	191	2.6	3.1	3.7	22.0	15.2	12.0	13.1	10.5	10.5	6.3	1.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	23
4.0	6.0	2.0	2.0	2,164	440	22.3	14.3	14.1	17.3	10.9	9.6	3.2	3.6	3.6	0.9	0.2	2	1	100.0	.....	.....	.....	.....	.....	.....	24

COTTON GOODS.

7.4	3.0	0.9	0.4	$494,118	81,937	6.2	10.5	14.6	16.7	18.1	13.9	9.9	6.0	3.7	0.4	(3)	$81,155	25,249	45.2	30.1	16.5	5.4	2.1	0.4	0.3	1
10.1	3.9	1.2	0.5	404,059	60,101	1.9	4.4	9.7	17.4	22.0	17.9	13.2	8.0	4.9	0.6	(3)	36,492	8,785	15.2	33.0	31.8	12.4	5.6	1.2	0.8	2
9.8	1.8	0.3	0.2	15,075	2,453	2.1	7.8	13.9	20.8	17.0	16.4	11.2	6.2	4.2	0.4	.....	461	185	41.1	50.3	4.9	2.7	0.5	0.5	.....	3
8.4	2.9	0.8	0.2	34,818	4,939	1.4	3.9	7.7	13.6	25.7	14.7	11.8	9.8	10.1	1.3	.....	774	185	6.5	42.2	31.9	12.4	6.5	0.5	.....	4
9.6	3.5	0.8	0.4	260,139	38,334	2.0	4.0	9.2	17.5	21.8	18.2	13.5	8.7	4.7	0.4	(3)	25,189	5,699	10.7	30.9	34.9	14.5	6.3	1.5	1.2	5
9.6	2.1	0.4	0.4	36,332	5,639	1.3	3.6	13.1	21.8	21.6	16.6	10.8	7.0	3.6	0.6	(3)	4,462	1,237	32.2	31.0	25.4	6.7	4.7	.....	.....	6
8.1	3.0	0.4	0.1	19,957	2,976	3.1	4.4	8.9	16.1	21.7	22.4	12.2	6.4	4.4	0.4	.....	2,011	500	17.2	30.0	26.2	17.4	7.2	1.8	0.2	7
13.8	4.2	0.1	0.5	3,008	475	0.6	6.5	13.5	26.3	19.8	17.5	10.1	2.3	3.4	.....	.....	267	64	10.9	28.1	37.5	23.5	.....	.....	.....	8
15.6	15.3	9.7	1.4	11,647	1,742	0.6	3.3	7.0	10.5	19.7	31.3	21.2	4.2	2.0	0.2	.....	1,109	295	9.2	30.8	49.8	4.1	5.1	0.7	0.3	9
19.4	13.0	7.3	3.0	23,083	3,543	2.4	7.5	11.9	15.5	25.2	11.7	13.4	5.2	4.9	2.1	0.2	2,219	620	19.0	53.5	18.9	6.0	1.6	1.0	.....	10
1.5	1.0	0.2	0.1	68,765	17,236	20.6	27.3	28.9	14.4	5.9	1.9	0.7	0.2	0.1	(3)	.....	37,108	13,774	60.7	28.8	8.7	1.7	0.1	(3)	.....	11
7.2	4.6	0.2	.....	6,733	1,328	2.2	9.2	49.1	12.8	13.5	7.0	3.5	2.0	0.7	.....	.....	1,534	585	68.9	28.2	2.7	0.2	.....	.....	.....	12
0.9	0.6	0.1	.....	25,791	6,747	18.3	35.2	29.3	11.6	4.2	1.0	0.2	0.1	0.1	.....	.....	13,342	5,060	60.5	33.7	4.7	1.0	0.1	.....	.....	13
0.8	0.6	0.3	0.1	21,851	5,712	26.6	25.4	24.7	16.3	4.9	1.5	0.6	(3)	.....	(3)	.....	14,512	5,183	61.7	23.9	12.0	2.3	0.1	(3)	.....	14
2.8	1.9	0.3	0.3	14,390	3,449	22.0	21.9	27.2	17.2	8.2	2.3	0.8	0.2	0.2	.....	.....	7,720	2,946	57.7	29.0	11.0	2.0	0.2	0.1	.....	15

[3] Less than one-tenth of 1 per cent.

TABLE 71.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE SELECTED INDUSTRIES, BY STATES, TERRITO- CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND AVERAGE WEEKLY EARNINGS, AND NUMBER

COTTON GOODS—Continued.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
16	North Central division	4	$5.42	$7.05	$4.76	$3.50	$5,702	1,052	$2,327	330	2.4	14.6	16.7	13.0	9.1	14.2	8.5	6.1	8.2
17	Indiana	4	5.42	7.05	4.76	3.50	5,702	1,052	2,327	330	2.4	14.6	16.7	13.0	9.1	14.2	8.5	6.1	8.2
18	South Central division	30	4.69	5.92	4.58	2.82	40,147	8,559	21,787	3,680	7.2	9.9	24.3	15.6	14.9	11.3	4.9	5.4	2.8
19	Tennessee	6	4.99	6.17	4.89	3.03	7,772	1,557	4,081	661	4.9	8.3	26.0	16.7	15.7	12.3	3.3	4.2	4.5
20	Alabama	19	4.61	5.77	4.43	2.83	27,638	5,995	15,486	2,684	8.2	10.9	24.9	15.0	14.4	10.2	5.5	5.3	2.3
21	Mississippi	5	4.70	6.63	4.84	2.52	4,737	1,007	2,220	335	4.2	4.8	15.8	18.2	17.0	17.9	3.3	9.5	3.3
22	All other states	[1] 14	5.37	7.23	4.67	2.66	14,744	2,745	7,630	1,056	4.6	12.3	13.6	9.0	15.8	9.8	5.5	8.3	9.6

ELECTRICAL MACHINERY, APPARATUS, AND SUPPLIES.

	STATE OR TERRITORY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	443	$9.88	$10.85	$6.37	$3.67	$364,509	36,875	$317,338	29,240	3.1	2.3	3.1	4.4	5.0	6.5	9.1	10.1	15.2
2	North Atlantic division	244	9.76	10.80	6.38	3.71	280,615	28,740	240,688	22,279	3.4	2.0	3.0	4.3	4.9	6.5	9.2	9.3	15.5
3	New Hampshire	3	10.67	11.49	3.38	......	843	79	816	71	1.4	1.4	1.4	5.7	2.8	5.6	14.1	14.1	15.5
4	Massachusetts	65	10.79	11.75	6.98	4.07	111,703	10,357	98,913	8,418	1.2	1.3	2.2	3.6	4.1	5.9	8.6	9.1	15.3
5	Rhode Island	9	7.11	7.76	5.49	3.38	11,185	1,574	8,793	1,133	1.0	1.8	1.7	9.0	7.0	9.1	27.2	12.2	13.3
6	Connecticut	19	8.79	10.11	6.04	3.39	14,119	1,607	11,645	1,152	2.3	2.9	5.6	6.4	6.1	10.2	10.1	11.6	14.2
7	New York	89	9.38	10.48	5.66	3.63	18,910	2,016	16,392	1,564	3.5	3.1	7.4	6.5	7.1	6.7	7.4	10.2	11.8
8	New Jersey	15	8.37	10.84	6.60	3.12	35,407	4,230	19,912	1,837	4.6	3.2	5.0	5.8	6.5	8.9	7.7	6.7	14.3
9	Pennsylvania	44	9.96	10.39	5.52	3.60	88,448	8,877	84,217	8,104	6.0	2.0	2.4	3.3	4.4	5.7	7.8	9.2	17.1
10	South Atlantic division	4	9.37	10.10	4.50	2.33	1,181	126	1,131	112	......	......	......	2.7	10.7	10.7	24.1	5.3	14.3
11	Maryland	4	9.37	10.10	4.50	2.33	1,181	126	1,131	112	......	......	......	2.7	10.7	10.7	24.1	5.3	14.3
12	North Central division	156	10.28	10.99	6.27	3.17	74,793	7,273	68,117	6,197	1.6	2.6	3.3	4.8	5.1	6.5	9.2	13.5	14.9
13	Ohio	54	9.62	10.31	6.00	3.00	29,284	3,043	26,486	2,568	1.4	2.0	4.1	4.0	4.6	8.7	11.2	17.5	13.2
14	Indiana	19	10.26	10.61	5.64	......	11,026	1,075	10,592	998	3.0	4.7	4.1	6.1	6.0	5.3	8.7	11.8	14.6
15	Illinois	48	10.80	11.69	6.80	3.67	16,004	1,482	14,214	1,216	0.7	1.8	1.3	3.3	4.8	5.4	7.2	11.8	18.5
16	Michigan	5	7.86	8.89	4.37	......	1,588	202	1,387	156	0.6	5.1	4.5	16.0	7.1	3.2	25.7	7.7	16.7
17	Wisconsin	12	11.90	12.31	4.84	......	10,755	904	10,513	854	1.3	2.0	2.3	5.3	5.7	4.5	6.1	8.5	17.4
18	Minnesota	8	12.19	12.19	......	......	695	57	695	57	......	14.0	......	1.7	8.8	3.5	1.8	......	10.5
19	Missouri	10	10.67	12.16	7.48	......	5,441	510	4,230	348	3.4	2.9	4.6	6.3	4.3	4.3	4.3	11.8	10.1
20	Western division	21	11.56	12.00	7.68	4.40	5,285	457	4,979	415	4.6	5.3	5.8	5.8	10.6	4.6	4.8	3.4	7.7
21	Colorado	5	9.50	9.64	7.00	......	722	76	694	72	4.2	8.3	9.7	8.3	9.7	4.2	5.6	4.2	9.7
22	California	16	11.98	12.49	7.76	4.40	4,563	381	4,285	343	4.7	4.7	5.0	5.2	10.8	4.7	4.7	3.2	7.3
23	All other states	[3] 18	9.44	10.22	5.37	2.00	2,635	279	2,423	237	6.7	19.8	3.4	1.3	3.0	5.9	1.7	8.0	9.3

FOUNDRY AND MACHINE SHOP PRODUCTS.

	STATE OR TERRITORY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	5,359	$11.79	$11.88	$5.83	$4.01	$2,901,465	246,177	$2,884,406	242,845	1.4	1.9	2.6	2.8	4.3	6.1	7.6	12.7	15.0
2	North Atlantic division	2,456	11.73	11.83	6.00	4.13	1,543,671	131,649	1,532,865	129,617	1.3	2.0	2.6	2.9	4.1	6.3	7.9	12.6	14.7
3	Maine	46	10.21	10.21	......	......	18,825	1,843	18,825	1,843	0.1	2.8	3.3	4.1	8.4	14.2	9.3	12.8	13.3
4	New Hampshire	40	11.22	11.25	6.00	3.40	16,736	1,492	16,707	1,485	0.4	1.7	3.0	2.6	5.9	7.4	5.4	13.7	16.6
5	Vermont	31	10.95	10.95	......	......	14,618	1,335	14,618	1,335	0.4	1.0	1.6	2.2	4.6	8.4	11.0	15.9	18.4
6	Massachusetts	599	11.62	11.73	6.43	4.24	402,536	34,655	398,962	34,012	0.7	1.0	2.1	2.6	4.6	6.0	7.6	14.2	16.4
7	Rhode Island	87	11.81	11.98	5.89	3.27	73,862	6,254	73,202	6,109	0.9	1.4	2.1	2.4	3.9	8.3	9.0	8.9	14.3
8	Connecticut	120	11.28	11.45	5.96	4.15	80,983	7,181	79,841	6,973	1.7	1.5	2.7	3.7	4.7	6.6	8.3	12.3	14.5
9	New York	710	12.04	12.13	5.90	3.74	361,088	29,985	358,831	29,588	1.4	2.5	2.8	2.7	3.5	5.4	6.6	12.5	14.6
10	New Jersey	207	11.45	11.64	5.61	4.26	161,998	14,144	159,911	13,741	1.7	2.7	2.9	3.2	3.6	6.5	8.2	12.6	14.3
11	Pennsylvania	616	11.88	11.93	5.73	4.35	413,025	34,760	411,968	34,531	1.9	2.3	2.8	3.0	3.8	6.2	9.0	11.8	13.2
12	South Atlantic division	285	11.29	11.36	4.53	3.42	110,227	9,762	109,931	9,681	3.3	3.9	4.3	3.9	7.7	11.5	7.2	8.7	9.5
13	Delaware	21	10.94	11.01	......	4.16	21,059	1,925	20,980	1,906	3.4	3.2	3.4	3.6	6.1	12.0	11.4	6.8	10.5
14	Maryland	78	12.61	12.62	......	3.17	47,386	3,759	47,367	3,753	3.4	2.7	2.8	1.9	3.8	11.1	8.6	9.0	10.9
15	District of Columbia	6	12.80	12.80	......	......	1,651	129	1,651	129	2.3	9.3	7.8	0.8	8.5	3.1	1.5	11.6	7.0
16	Virginia	34	9.97	10.04	......	2.71	7,968	799	7,949	792	0.7	3.8	3.3	3.7	16.9	20.3	6.2	8.1	6.8
17	West Virginia	37	12.86	12.94	7.25	5.50	10,468	814	10,406	804	1.0	1.9	2.2	1.3	3.4	6.7	4.2	18.0	12.2
18	North Carolina	38	9.44	9.52	2.50	2.25	5,381	570	5,367	564	2.8	2.9	9.6	10.5	13.8	8.3	1.1	7.8	7.1
19	South Carolina	24	6.80	7.10	3.91	1.80	1,415	208	1,363	192	7.3	14.1	16.2	4.7	15.1	9.4	2.1	10.9	3.6
20	Georgia	42	9.55	9.62	......	3.00	14,357	1,504	14,306	1,487	5.0	7.7	7.1	8.5	13.0	12.1	4.1	5.7	6.7
21	Florida	5	10.04	10.04	......	......	542	54	542	54	1.8	3.7	13.0	1.8	16.7	5.6	3.7	5.6	5.6

[1] Includes Arkansas, 1; Illinois, 1; Kentucky, 2; Louisiana, 1; Ohio, 1; Texas, 2; Vermont, 2; Virginia, 2; Wisconsin, 2.
[2] Less than one-tenth of 1 per cent.

RIES, AND GEOGRAPHIC DIVISIONS—PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND OF ALL WAGE-EARNERS AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

COTTON GOODS—Continued.

Men 16 years and over—continued. Per cent distribution of number by earnings—Continued. $12 to $15.	$15 to $20.	$20 to $25.	$25 and over	Women 16 years and over. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over	Children under 16 years. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
2.4	3.9	0.9		$3,200	672	3.1	23.1	30.5	15.6	11.6	6.4	4.9	2.4	2.2	0.2		$175	50	26.0	60.0	6.0	8.0				16
2.4	3.9	0.9		3,200	672	3.1	23.1	30.5	15.6	11.6	6.4	4.9	2.4	2.2	0.2		175	50	26.0	60.0	6.0	8.0				17
1.9	1.1	0.4	0.3	11,992	2,620	10.3	30.5	24.7	17.8	11.9	4.1	0.4	0.2	0.1			6,368	2,259	65.7	25.1	6.5	2.2	0.5			18
2.1	1.4	0.6		2,563	524	7.3	23.7	22.3	18.5	22.3	5.5	0.4					1,128	372	54.3	35.5	5.1	4.0	1.1			19
1.6	0.9	0.4	0.4	7,707	1,740	12.6	34.0	25.5	14.9	8.5	3.7	0.4	0.3	0.1			4,445	1,571	66.8	23.6	7.4	2.0	0.2			20
3.9	2.1			1,722	356	3.4	23.6	24.4	30.6	13.8	3.6	0.6					795	316	73.4	20.9	3.5	0.9	1.3			21
6.0	3.2	0.9	1.4	6,102	1,308	10.4	24.5	20.9	15.5	15.0	8.3	2.5	2.2	0.5		0.2	1,012	381	57.7	35.4	5.5	0.8	0.3	0.3		22

ELECTRICAL MACHINERY, APPARATUS, AND SUPPLIES.

20.0	16.4	3.7	1.1	$45,223	7,104	4.6	7.2	13.2	17.9	18.8	17.4	12.1	4.8	3.2	0.8	(2)	$1,948	531	25.2	32.8	26.4	9.0	3.8	1.7	1.1	1
20.6	16.8	3.5	1.0	38,096	5,968	4.9	6.4	12.3	18.5	18.8	17.8	12.9	4.4	3.2	0.7	0.1	1,831	493	22.1	34.3	27.4	9.3	3.9	1.8	1.2	2
12.7	21.1	4.2		27	8	50.0		25.0	12.5		12.5															3
25.9	19.0	3.2	0.6	11,752	1,684	3.2	5.0	9.6	15.9	16.3	19.7	20.1	5.0	4.0	1.2		1,038	255	18.8	22.7	31.4	14.5	6.7	3.5	2.4	4
12.0	4.2	1.2	0.3	2,348	428	1.4	12.6	14.0	31.1	17.3	14.7	7.0	1.2	0.5	0.2		44	13	23.1	30.8	46.1					5
17.1	9.1	3.5	0.9	2,125	352	3.4	5.7	15.9	25.3	27.3	10.5	4.8	2.8	2.3	2.0		349	103	17.5	48.5	34.0					6
14.2	16.4	3.5	2.2	2,449	433	3.5	11.3	26.3	17.3	16.4	12.7	8.3	1.9	2.1	0.2		69	19		84.2		10.5	5.3			7
13.8	18.0	4.3	1.2	15,236	2,310	5.7	5.1	11.6	17.1	17.7	17.2	14.0	6.7	4.4	0.4	0.1	259	83	38.6	47.0	8.4	4.8	1.2			8
19.8	17.0	3.9	1.4	4,159	753	9.4	7.8	10.2	18.9	26.0	23.5	3.2	0.4	0.3	0.3		72	20	40.0	10.0	35.0	15.0				9
16.0	11.6	2.7	1.9	36	8	12.5		37.5	25.0	25.0							14	6	83.3	16.7						10
16.0	11.6	2.7	1.9	36	8	12.5		37.5	25.0	25.0							14	6	83.3	16.7						11
18.6	15.3	3.3	1.3	6,603	1,053	2.8	11.2	16.6	14.9	19.7	16.0	7.7	7.2	2.9	1.0		73	23	69.6	13.0	13.0		4.4			12
17.3	13.2	2.2	0.6	2,747	458	2.0	10.7	24.2	16.6	20.3	11.6	7.6	5.0	1.1	0.9		51	17	82.3	5.9	11.8					13
18.4	14.3	2.4	0.6	434	77	7.8	10.4	15.6	20.8	15.5	24.7		3.9	1.3												14
24.7	15.4	4.2	0.9	1,768	260	1.5	10.4	8.1	16.9	14.6	17.7	9.2	13.1	7.3	1.2		22	6	33.3	33.3	16.7		16.7			15
9.6	3.2	0.6		201	46	8.7	52.2	15.2	8.7	8.7		4.3	2.2													16
16.8	21.3	5.5	3.3	242	50	12.0	18.0	28.0	16.0	16.0	2.0	4.0	2.0	2.0												17
10.5	43.9	1.8	3.5																							18
17.2	19.0	7.5	4.3	1,211	162	0.6	0.6	6.2	5.6	32.1	30.3	11.1	8.6	3.0	1.9											19
13.5	14.9	17.1	1.9	284	37			18.9	10.8	10.8	2.7	27.1	13.5	13.5	2.7		22	5		20.0	40.0	40.0				20
5.6	20.8	9.7		28	4					75.0			25.0													21
15.1	13.7	18.6	2.3	256	33			21.2	12.1	3.1	3.0	30.3	12.1	15.2	3.0		22	5		20.0	40.0	40.0				22
18.6	14.8	6.7	0.8	204	38	7.9	18.4	28.9	15.8	10.5	13.2				5.3		8	4	100.0							23

FOUNDRY AND MACHINE SHOP PRODUCTS.

18.7	21.1	4.5	1.3	$11,813	2,025	3.5	10.3	17.3	25.3	20.3	11.7	4.3	3.2	2.6	0.9	0.6	$5,246	1,307	17.4	36.3	29.7	8.0	5.0	1.4	2.2	1
19.0	21.4	3.9	1.3	7,742	1,291	2.6	6.1	17.2	27.7	21.8	12.6	4.0	3.3	2.6	1.2	0.9	3,064	741	18.2	32.3	31.7	9.7	4.7	1.1	2.3	2
14.5	16.0	0.9	0.3																							3
19.9	21.8	1.4	0.2	12	2		50.0				50.0						17	5	20.0	80.0						4
22.5	12.2	1.4	0.4																							5
20.1	20.5	3.3	0.9	2,493	388	1.8	6.4	18.6	20.6	22.9	12.9	5.2	3.9	3.6	2.6	1.5	1,081	255	19.6	29.0	35.7	10.2	3.5	0.8	1.2	6
23.8	20.5	3.5	1.0	418	71	5.6	9.9	11.3	8.5	22.5	32.4	4.2	2.8	1.4	1.4		242	74	46.0	32.4	18.9	2.7				7
20.8	20.1	2.4	0.7	918	154	4.5	5.2	7.8	22.7	39.0	7.2	3.9	4.5	5.2			224	54	5.6	42.6	25.9	22.2	1.8	1.9		8
17.9	24.2	4.5	1.4	2,111	358	1.4	7.5	24.9	21.0	19.8	15.9	3.9	3.6	0.8	0.6	0.6	146	39	17.9	43.6	20.5	7.7	10.3			9
17.7	22.0	3.7	0.9	1,538	274	0.7	3.3	12.4	56.9	15.7	5.1	0.7	1.5	1.5	0.7	1.5	549	129	6.2	31.8	44.2	9.3	8.5			10
18.2	20.8	5.0	2.0	252	44	18.2	4.6	15.9	13.6	6.8	13.6	13.6	4.6	6.8	2.3		805	185	17.3	30.3	27.6	9.2	5.4	2.7	7.5	11
15.7	16.1	4.4	3.8	77	17	35.3	11.8	17.6	17.6	11.8				5.9			219	64	43.8	23.4	17.2	7.8	7.8			12
16.3	16.8	4.0	2.5														79	19	10.5	26.3	36.9	26.3				13
17.5	17.2	4.5	6.6														19	6	50.0	50.0						14
10.1	22.5	10.1	5.4																							15
13.5	12.4	2.9	1.4														19	7	42.9	57.1						16
14.9	22.9	8.1	3.2	29	4				50.0	25.0				25.0			33	6		16.7			83.3			17
22.3	10.8	2.3	0.7	5	2	100.0											9	4	75.0	25.0						18
9.4	6.2	0.5	0.5	43	11	36.3	18.2	27.3	9.1	9.1							9	5	100.0							19
10.4	13.7	4.4	1.6														51	17	70.6	5.9	23.5					20
18.5	22.2	1.8																								21

[3] Includes Delaware, 1; District of Columbia, 1; Georgia, 1; Iowa, 2; Kentucky, 2; Louisiana, 2; Maine, 2; Nebraska, 2; Oregon, 2; Tennessee, 2; Texas, 1; Virginia, 1.

TABLE 71.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE SELECTED INDUSTRIES, BY STATES, TERRITO- CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND AVERAGE WEEKLY EARNINGS, AND NUMBER

FOUNDRY AND MACHINE SHOP PRODUCTS—Continued.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
22	North Central division	1,968	$11.66	$11.74	$5.55	$3.68	$1,055,905	90,589	$1,050,538	89,486	1.3	1.7	2.4	2.6	3.7	5.2	7.8	14.2	17.2
23	Ohio	516	11.31	11.35	5.79	3.46	334,890	29,617	334,180	29,451	2.0	2.2	2.9	3.2	4.1	5.5	8.0	14.8	15.5
24	Indiana	206	10.60	10.76	4.24	3.21	101,316	9,561	100,338	9,321	2.0	2.1	3.4	3.8	4.5	8.2	9.7	14.8	15.6
25	Illinois	424	12.56	12.69	6.11	3.70	302,898	24,122	300,372	23,672	0.9	0.8	1.5	1.9	3.4	3.9	5.6	12.4	20.6
26	Michigan	260	11.24	11.29	5.29	4.05	104,621	9,309	104,312	9,237	0.5	2.1	2.6	2.4	3.7	6.7	6.5	16.2	17.5
27	Wisconsin	158	11.62	11.70	5.18	3.79	105,687	9,098	105,243	8,993	0.7	1.8	2.4	1.6	3.1	3.9	14.3	15.4	13.8
28	Minnesota	89	12.18	12.19	8.00		15,222	1,250	15,182	1,245	0.5	0.6	3.1	2.1	2.7	4.0	6.5	12.5	14.1
29	Iowa	106	10.99	11.06	7.48	4.29	22,322	2,031	22,105	1,999	1.1	2.2	2.6	2.5	4.9	5.1	6.9	13.5	20.7
30	Missouri	118	12.43	12.48	5.43	3.95	50,688	4,079	50,563	4,050	0.7	0.8	1.4	2.6	2.5	4.6	3.9	12.9	20.0
31	North Dakota	13	13.51	13.67		3.00	878	65	875	64				1.6	3.1	1.6		14.1	15.6
32	South Dakota	[illegible]	13.72	13.72			439	32	439	32								18.8	6.2
33	Nebraska	18	12.06	12.06			2,327	193	2,327	193		1.0	1.0	3.1	4.7	11.4	2.1	8.8	18.7
34	Kansas	52	11.86	11.88	9.00	3.00	14,617	1,232	14,602	1,229	1.7	2.3	1.7	3.3	5.0	4.5	7.0	11.1	16.8
35	South Central division	235	10.30	10.34	4.00	3.57	56,231	5,459	56,107	5,425	4.2	3.1	4.2	4.0	15.6	10.6	5.7	10.6	7.6
36	Kentucky	41	10.23	10.31	4.00	3.50	10,589	1,035	10,544	1,023	4.5	3.1	4.1	3.3	6.5	11.4	8.1	12.6	11.3
37	Tennessee	47	9.32	9.36		3.00	13,045	1,399	13,024	1,392	2.3	3.1	5.1	3.7	28.5	8.2	7.2	9.2	3.8
38	Alabama	20	9.42	9.44		2.33	12,293	1,305	12,286	1,302	7.2	4.5	5.2	6.7	23.0	7.8	4.7	6.5	6.3
39	Mississippi	15	11.73	11.91		3.00	1,173	100	1,167	98	1.0	2.0	1.0	2.0	12.2	12.3		17.4	6.1
40	Louisiana	21	11.36	11.42		3.50	3,273	288	3,266	286	3.2	4.9	4.2	2.8	4.2	8.7	5.2	8.4	12.6
41	Arkansas	22	10.82	10.92		5.00	2,706	250	2,686	246	10.2	3.2	4.5	2.8	6.1	9.8	4.5	11.0	7.3
42	Indian Territory	7	11.65	11.80		7.00	361	31	354	30	6.7			3.3		6.7		13.3	16.7
43	Oklahoma	9	12.08	12.27		3.00	592	49	589	48	2.1	2.1	2.1	2.1	2.1	2.1		8.3	12.5
44	Texas	53	12.17	12.19		4.00	12,199	1,002	12,191	1,000	2.1	1.1	2.2	2.6	4.3	17.9	3.8	15.6	8.9
45	Western division	409	15.51	15.61	8.56	5.33	133,273	8,592	132,807	8,510	0.5	0.9	1.5	1.8	2.8	2.4	1.4	3.6	7.1
46	Montana	6	19.27	19.31		8.00	5,686	295	5,678	294				0.3	1.0	1.4	1.4	3.4	3.4
47	Colorado	64	14.61	14.72		4.33	16,818	1,151	16,766	1,139	0.9	0.9	1.0	1.7	2.3	1.7	2.3	8.8	15.2
48	Arizona	5	17.81	17.81			481	27	481	27								7.4	
49	Utah	6	14.14	14.14			297	21	297	21			4.7				4.8	23.8	
50	Washington	64	15.82	15.86		5.00	17,354	1,097	17,334	1,093	1.6	2.1	1.6	2.6	1.8	2.4	0.7	3.0	2.5
51	Oregon	26	16.02	16.02			11,089	692	11,089	692	0.1	0.3	2.0	0.7	2.5	1.3	1.2	3.9	6.5
52	California	238	15.36	15.48	8.56	5.52	81,548	5,309	81,162	5,244	0.3	0.8	1.6	1.9	3.2	2.7	1.4	2.4	6.7
53	All other states	[1] 6	17.13	17.13			2,158	126	2,158	126								20.6	5.6

FURNITURE.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	1,257	$9.86	$10.16	$5.53	$3.55	$560,955	56,918	$545,793	53,715	1.7	2.3	3.9	4.5	7.4	10.5	9.8	13.7	15.2
2	North Atlantic division	544	10.33	10.62	6.53	4.08	215,197	20,825	207,563	19,541	1.2	1.7	2.7	3.3	5.9	9.8	10.7	13.3	17.2
3	Maine	5	10.03	10.11		3.50	1,615	161	1,608	159						4.4	23.3	6.3	50.3
4	New Hampshire	14	9.12	9.22	4.00	2.25	3,713	407	3,696	401	5.2	2.7	2.0	4.0	7.2	11.2	10.7	14.0	21.2
5	Vermont	8	8.16	8.16			2,873	352	2,873	352	0.9	1.1	10.0	3.7	17.3	21.6	13.6	12.2	8.2
6	Massachusetts	110	10.48	11.05	6.88	4.66	72,299	6,899	66,784	6,045	0.5	1.1	1.6	2.5	3.7	8.4	12.0	14.5	18.6
7	Rhode Island	3	15.35	15.35			476	31	476	31						3.2	6.5		
8	Connecticut	12	12.06	12.20	8.00	5.00	1,628	135	1,610	132	0.8	1.5	0.7	6.1	7.6	3.0	4.5	11.4	11.4
9	New York	257	10.39	10.54	5.52	3.48	90,399	8,702	89,119	8,458	1.3	1.9	3.1	3.8	5.9	9.9	10.0	13.0	16.9
10	New Jersey	19	11.28	11.67	6.61		6,405	568	6,114	524	1.0	2.3	4.8	3.4	5.7	7.4	5.7	8.6	12.4
11	Pennsylvania	116	10.02	10.26	5.50	3.46	35,789	3,570	35,283	3,439	1.8	2.3	3.0	3.4	8.9	11.3	10.1	13.3	15.4
12	South Atlantic division	106	7.00	7.36	2.13	2.76	32,845	4,690	31,883	4,333	7.2	6.8	11.5	13.8	17.5	11.7	5.1	7.0	6.3
13	Maryland	30	9.46	9.84	6.80	3.06	12,339	1,305	12,088	1,229	5.5	3.3	6.6	7.1	9.6	9.1	7.8	9.6	12.2
14	Virginia	8	6.70	6.89		3.40	1,260	188	1,226	178	7.9	8.4	10.1	14.0	21.4	12.9	6.2	5.6	2.3
15	West Virginia	[illegible]	8.44	8.54	2.67		1,579	187	1,571	184	10.9	6.0	7.6	5.4	9.8	10.9	5.4	11.4	6.5
16	North Carolina	41	5.66	5.88		2.67	12,091	2,138	11,698	1,991	7.2	7.8	15.1	19.3	23.2	14.6	3.2	4.8	2.5
17	South Carolina	3	5.76	6.09		2.00	363	63	353	58	3.5	20.7	6.9	24.1	20.7	5.2	1.7	1.7	12.1
18	Georgia	15	6.44	7.14	1.30	2.64	5,213	809	4,947	693	9.7	8.6	11.8	11.1	15.6	8.4	5.8	8.2	7.4
19	North Central division	472	9.86	10.15	4.55	3.83	271,374	27,520	265,650	26,179	1.0	1.8	3.4	3.7	6.8	11.0	10.7	15.6	15.8
20	Ohio	97	9.22	9.58	4.62	3.50	39,035	4,232	37,664	3,932	2.0	3.7	4.8	6.7	8.0	11.2	9.1	13.8	14.5
21	Indiana	98	8.96	9.39	3.58	3.44	54,635	6,095	53,079	5,655	1.1	2.7	3.8	4.9	8.0	13.1	13.7	13.9	16.6
22	Illinois	93	12.35	12.46	5.00	4.16	64,979	5,262	64,646	5,187	0.6	0.7	1.7	2.3	3.4	3.4	4.7	12.5	14.1
23	Michigan	56	9.56	9.78	5.76	4.23	58,154	6,082	56,799	5,809	0.4	0.8	3.1	2.5	5.8	10.8	13.1	22.1	19.7
24	Wisconsin	47	8.39	8.61	4.51	3.66	29,740	3,544	29,128	3,385	1.5	0.9	5.1	2.2	11.6	21.9	15.1	16.3	12.1
25	Minnesota	18	8.88	8.97	4.50		4,361	491	4,316	481	2.1	4.8	2.5	6.4	8.1	15.8	13.1	13.3	12.3
26	Iowa	19	9.86	10.02	6.25	3.56	5,434	551	5,352	534	1.5	3.9	3.6	5.4	5.4	7.1	10.9	12.5	16.3
27	Missouri	35	11.98	12.35	7.84	4.12	13,809	1,153	13,487	1,092	0.6	1.0	1.7	3.0	3.1	3.6	2.9	8.4	16.9
28	Nebraska	4	11.30	11.56	10.25	3.50	915	81	867	75							2.7	42.7	16.0
29	Kansas	5	10.76	10.76			312	29	312	29			3.5	3.4	6.9			20.7	20.7
30	South Central division	47	8.58	9.00	2.63	3.05	22,408	2,611	21,872	2,429	4.5	4.4	6.5	7.3	10.5	11.1	6.2	12.8	10.5
31	Kentucky	18	9.46	9.79	4.14	2.78	5,743	607	5,650	577	1.7	2.9	2.9	4.3	9.2	8.7	6.4	13.3	17.0
32	Tennessee	15	8.43	8.76		3.04	9,791	1,162	9,587	1,095	5.2	4.0	9.7	8.6	12.1	13.4	6.5	6.0	9.4
33	Alabama	4	8.59	8.59			550	64	550	64		4.7	6.3	1.6	23.4	12.5	18.8	15.6	6.2
34	Louisiana	3	9.03	9.20		3.50	2,999	332	2,964	322		9.3	1.9	11.5	8.7	1.9	1.2	35.4	5.9
35	Arkansas	4	6.37	7.52	1.77	2.76	1,893	297	1,751	233	18.4	5.1	4.7	6.9	8.1	17.2	7.7	8.2	8.2
36	Texas	3	9.61	9.93	7.50	4.57	1,432	149	1,370	138			10.9	3.6	5.1	13.8	5.8	18.8	9.4
37	Western division	83	15.10	15.32	8.67	4.43	18,707	1,239	18,416	1,202	0.3	0.8	1.3	1.8	3.8	3.8	1.7	6.2	8.8
38	Colorado	8	16.93	17.04		4.00	2,083	123	2,079	122					2.5	2.5	0.8	4.9	4.9
39	Washington	13	13.42	13.52	5.00		1,181	88	1,176	87	1.2		1.2	5.7	6.9	1.2	2.3	12.6	3.4
40	Oregon	11	12.21	12.32	8.00		3,845	315	3,781	307		1.6	3.2	1.0	4.9	7.2	3.3	8.5	16.6
41	California	51	16.27	16.59	9.10	4.50	11,598	713	11,380	686	0.3	0.6	0.7	1.9	3.2	2.9	1.2	4.5	6.7
42	All other states	[2] 5	12.85	13.19	7.50		424	33	409	31						3.2		22.6	19.3

[1] Includes Alaska, 1; Idaho, 2; Nevada, 1; New Mexico, 2.

RIES, AND GEOGRAPHIC DIVISIONS—PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND OF ALL WAGE-EARNERS AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

FOUNDRY AND MACHINE SHOP PRODUCTS—Continued.

MEN 16 YEARS AND OVER—continued.				WOMEN 16 YEARS AND OVER.													CHILDREN UNDER 16 YEARS.									
Per cent distribution of number by earnings—Continued.				Earnings.	Number.	Per cent distribution of number by earnings.											Earnings.	Number.	Per cent distribution of number by earnings.							
$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
19.1	20.6	3.3	0.9	$3,893	702	4.4	17.8	17.7	21.0	18.1	10.3	5.1	3.1	2.1	0.4		$1,474	401	14.2	47.9	29.9	4.0	2.7	0.8	0.5	22
19.8	18.5	2.8	0.7	336	58		10.3	27.6	27.6	17.3		5.2	1.7	10.3			374	108	14.8	45.4	38.9	0.9				23
17.2	15.8	2.3	0.6	856	202	5.4	38.6	33.7	14.8	4.0	2.0		0.5	1.0			122	38	39.5	34.2	26.3					24
19.2	24.3	4.2	1.3	2,182	357	3.6	9.8	6.4	26.6	26.3	14.3	7.6	3.1	1.7	0.6		344	93	24.7	46.3	11.8	7.5	5.4	3.2	1.1	25
19.0	20.1	2.3	0.4	74	14			57.2	14.3	14.3	7.1	7.1					235	58		51.8	36.2	1.7	8.6		1.7	26
19.2	19.5	3.4	0.9	171	33	15.1	15.2	24.2		27.3	6.1	12.1					273	72	2.8	62.5	27.8	5.5	1.4			27
21.0	27.4	5.3	0.2	40	5	20.0						20.0	40.0		20.0											28
16.2	20.7	2.8	0.8	187	25		4.0		4.0	12.0	52.0		24.0	4.0			30	7		42.8	42.9	14.3				29
17.7	25.7	5.6	1.6	38	7	14.3		14.3	42.8	14.3	14.3						87	22		31.8	59.1	9.1				30
20.3	34.4	7.8	1.5														3	1	100.0							31
21.9	46.9	6.2																								32
22.3	22.8	3.1	1.0																							33
20.7	20.8	3.7	1.4	9	1								100.0				6	2		100.0						34
10.5	17.1	5.4	1.4	24	[illegible]		33.4	33.3	33.3								100	[illegible]	14.3	46.4	28.6	3.6		7.1		35
13.5	16.8	4.7	0.1	24	6		33.4	33.3	33.3								21	6	16.7	50.0	16.7	16.6				36
8.7	16.9	3.1	0.2														21	7		100.0						37
8.7	13.2	4.3	1.9														7	3	66.7		33.3					38
12.3	30.6	3.1															6	2	50.0	50.0						39
11.2	28.7	4.9	1.0														7	2		50.0	50.0					40
7.3	24.8	6.5	2.0														20	4			75.0			25.0		41
26.7	23.3	3.3															7	1						100.0		42
31.2	29.2	6.2															[illegible]	1		100.0						43
11.1	15.5	10.9	4.0														[illegible]	2			100.0					44
20.4	28.7	24.5	4.4	77	9				22.2	11.1	22.2	11.1		22.3		11.1	389	73	4.1	21.9	19.2	15.1	19.2	6.8	13.7	45
6.1	38.4	22.8	21.8														[illegible]	1						100.0		46
15.6	33.3	13.2	3.1														52	12	8.3	41.7	8.3	8.3	33.4			47
25.9	22.2	40.8	3.7																							48
28.6	9.5	28.6																								49
22.9	25.0	29.9	3.9														20	4		25.0	25.0		50.0			50
23.3	19.9	36.3	2.0																							51
21.4	29.2	24.3	4.1	77	9				22.2	11.1	22.2	11.1		22.3		11.1	309	56	3.6	17.9	21.4	17.9	14.3	7.1	17.8	52
7.9	18.3	39.7	7.9																							53

FURNITURE.

17.4	11.1	2.0	0.5	$10,577	1,911	13.7	14.2	13.2	18.5	13.7	10.9	6.2	3.5	3.2	2.2	0.7	$4,585	1,292	30.5	32.9	20.8	11.9	3.3	0.5	0.1	1
18.4	13.0	2.3	0.5	6,380	977	4.0	8.5	10.1	18.7	17.0	16.4	10.3	5.7	4.9	3.6	0.8	1,254	307	18.6	26.4	18.6	28.7	6.8	0.6	0.3	2
10.7	3.1	1.3	0.6														7	2		100.0						3
15.5	4.7	1.3	0.3	[illegible]	2			100.0									9	4	100.0							4
5.1	3.7	2.0	0.6																							5
19.3	15.6	1.7	0.5	4,765	693	0.7	5.1	6.2	21.2	18.5	19.6	13.0	6.9	5.2	3.3	0.3	750	161	11.2	14.9	13.7	47.2	11.2	1.2	0.6	6
25.8	61.3	3.2																								7
15.9	31.1	4.5	1.5	[illegible]	1							100.0					10	[illegible]		50.0		50.0				8
19.7	11.2	2.8	0.5	1,165	211	13.7	16.6	22.3	12.8	13.3	6.2	2.4	2.4	4.2	4.2	1.9	115	33	12.1	60.6	21.2	6.1				9
20.0	23.7	3.8	1.2	291	44	6.8	13.6	11.4	18.2	9.1	13.6	6.8	6.8	6.8	2.3	4.6										10
15.9	12.1	2.0	0.5	143	26	7.7	26.9	7.7	3.9	23.1	19.2	3.8			7.7		363	105	29.5	32.4	26.7	8.6	2.8			11
7.1	4.7	0.9	0.4	81	38	73.7	13.2		2.6	2.6	5.3	2.6					881	319	60.8	30.1	8.5		0.6			12
13.0	12.7	2.4	1.1	34	5				20.0	20.0	40.0	20.0					217	71	53.5	36.6	9.9					13
6.7	4.5																34	10	50.0	30.0			20.0			14
15.2	9.3	1.6		8	3	33.3	66.7																			15
1.6	0.6	0.1															393	147	65.3	25.9	8.8					16
1.7		1.7															10	5	100.0							17
11.0	1.6	0.4	0.4	39	30	90.0	10.0										227	86	58.2	33.7	8.1					18
18.5	10.4	0.9	0.4	3,720	818	20.2	21.4	18.6	20.0	11.0	4.4	1.7	0.7	0.9	0.7	0.4	2,004	523	15.9	38.0	30.4	11.7	3.3	0.7		19
17.2	7.2	1.0	0.8	1,322	286	16.4	21.7	23.4	23.8	9.8	2.8		1.0	0.4	0.7		49	14	21.4	50.0	14.3	14.3				20
15.8	5.5	0.6	0.3	1,075	300	38.7	24.3	11.3	14.0	9.7	1.0	0.7		0.3			481	140	34.3	30.7	27.9	7.1				21
30.8	23.9	1.5	0.4	125	25	8.0	24.0	32.0	24.0	4.0	4.0					4.0	208	50	2.0	50.0	24.0	14.0	10.0			22
13.7	6.9	0.8	0.3	755	131		17.5	18.3	22.1	22.9	8.4	3.8	0.8	3.1	2.3	0.8	600	142	4.9	30.3	40.9	14.1	7.0	2.8		23
9.7	3.0	0.5	0.1	158	35		28.6	22.8	48.6								454	124	16.9	46.0	26.6	10.5				24
12.9	8.3	0.4		45	10			100.0																		25
21.1	10.9	0.8	0.6	50	[illegible]			12.5	12.5	12.5	62.5						32	[illegible]		66.7	33.3					26
32.1	24.2	2.0	0.5	149	19		5.3		5.3		42.1	31.6	10.5	5.2			173	42	7.1	38.1	28.6	21.4	4.8			27
16.0	16.0	6.6		41	4					25.0		25.0			25.0	25.0	7	2		100.0						28
24.1	20.7																									29
15.6	9.0	1.0	0.6	121	46	65.2	17.4	2.2	2.2	2.2	6.5	2.2	2.1				415	136	43.4	36.0	16.9	3.0	0.7			30
25.0	8.0	0.2	0.4	29	7		85.7				14.3						64	23	65.2	4.4	30.4					31
12.1	11.0	1.6	0.4														204	67	35.8	44.8	17.9	1.5				32
6.2	3.1		1.6																							33
14.0	8.7	0.6	0.9														35	10	50.0	50.0						34
7.7	5.2	0.9	1.7	62	35	85.7	5.7	2.9	2.9		2.8						80	29	51.7	41.4	3.5	3.4				35
25.4	7.2			30	4					25.0	25.0	25.0	25.0				32	7		14.3	42.9	28.6	14.2			36
19.1	23.6	24.6	4.2	260	30				16.7	10.0	20.0	10.0	10.0	20.0	6.7	6.6	31	7	14.3		42.9	14.2	28.6			37
16.4	34.4	31.1	2.5														4	1			100.0					38
18.4	27.6	18.4	1.1	5	1				100.0																	39
30.3	19.2	2.9	1.3	64	8				50.0				25.0		25.0											40
14.6	23.2	33.9	6.3	191	21					14.3	28.6	14.3	4.7	28.6		9.5	27	6	16.7		33.3	16.7	33.3			41
22.6	9.7	22.6		15	2						100.0															42

[2] Includes District of Columbia, 1; Florida, 1; Indian Territory, 1; South Dakota, 2.

TABLE 71.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE SELECTED INDUSTRIES, BY STATES, TERRITO- CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND AVERAGE WEEKLY EARNINGS, AND NUMBER

GLASS.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	171	$12.82	$14.10	$5.08	$4.22	$466,343	36,368	$444,361	31,510	1.8	2.5	4.7	5.3	5.4	5.8	6.2	10.6	12.8
2	North Atlantic division	79	13.14	14.42	5.88	4.26	255,799	19,467	243,384	16,875	0.7	1.4	4.3	3.3	5.4	5.6	5.3	11.4	15.2
3	Massachusetts	3	10.55	11.38	5.44	3.69	10,316	978	9,660	849	2.4	3.2	10.2	5.4	6.5	4.7	7.8	7.4	13.7
4	New York	12	12.41	13.22	5.26	3.89	29,148	2,348	28,180	2,132	1.5	2.0	9.7	7.2	9.9	6.2	4.3	7.6	8.5
5	New Jersey	5	13.19	14.63	4.09	3.96	21,827	1,655	20,935	1,431	0.4	5.9	7.5	3.6	13.3	7.6	2.4	10.8	6.5
6	Pennsylvania	59	13.43	14.81	6.15	4.34	194,508	14,486	184,609	12,463	0.5	0.7	2.6	2.5	3.6	5.4	5.6	12.4	17.4
7	South Atlantic division	22	13.59	15.66	3.89	3.16	37,179	2,735	35,571	2,272	3.3	12.2	5.3	3.5	2.3	4.3	2.0	9.6	9.1
8	Maryland	3	13.12	14.93	3.58	2.61	8,319	634	8,062	540	1.9	28.9	9.4	1.5	0.6	8.7	0.7	4.5	3.7
9	West Virginia	19	13.74	15.88	3.91	3.41	28,860	2,101	27,509	1,732	3.8	6.9	4.0	4.2	2.9	2.9	2.4	11.2	10.7
10	North Central division	66	12.23	13.35	4.29	4.47	167,559	13,700	160,020	11,989	2.8	2.0	5.0	8.2	6.0	6.3	8.5	9.9	10.2
11	Ohio	12	12.93	15.11	4.97	4.15	43,875	3,393	40,753	2,697	0.5	0.8	9.7	5.9	2.3	11.5	11.2	7.1	6.2
12	Indiana	42	11.49	12.24	3.72	4.68	86,509	7,531	83,407	6,812	4.3	3.1	4.7	10.9	8.1	5.6	6.1	8.4	9.1
13	Illinois	3	14.30	17.13	3.86	4.70	12,670	886	11,754	686	......	......	......	9.2	3.9	1.9	13.4	15.3	11.5
14	Missouri	3	11.15	11.45	4.20	4.61	10,995	986	10,801	943	......	......	......	......	0.4	2.3	20.1	18.1	27.6
15	Kansas	6	14.94	15.63	3.86	4.00	13,510	904	13,305	851	4.0	0.7	1.9	1.7	9.5	4.1	2.5	16.9	11.1
16	All other states	[1]4	12.46	14.40	7.00	3.27	5,806	466	5,386	374	8.3	5.3	7.5	10.2	4.3	4.0	1.6	8.8	9.4

HOSIERY AND KNIT GOODS.

	STATE OR TERRITORY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total Earnings.	Total Number.	Men Earnings.	Men Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	416	$6.48	$8.90	$6.01	$3.19	$293,843	45,347	$102,843	11,558	2.8	3.6	5.9	6.8	12.5	13.9	12.3	11.1	13.3
2	North Atlantic division	295	6.98	9.29	6.42	3.52	237,727	34,053	86,214	9,285	1.7	2.5	4.2	5.7	12.0	15.0	13.2	11.9	14.7
3	New Hampshire	12	7.18	8.88	6.60	2.36	10,659	1,485	3,800	428	3.3	2.3	3.0	4.0	9.3	18.7	14.3	13.1	15.7
4	Vermont	3	7.70	9.26	7.01	3.10	4,191	544	1,714	185	0.5	0.5	2.2	3.8	11.9	23.2	11.4	15.7	12.4
5	Massachusetts	45	6.98	9.40	6.35	3.98	55,427	7,937	19,345	2,057	0.8	1.1	4.4	8.8	16.4	13.4	12.8	9.5	11.4
6	Rhode Island	11	6.96	10.17	6.22	3.41	8,602	1,236	2,858	281	......	3.6	3.2	8.2	7.8	13.9	9.2	8.5	16.0
7	Connecticut	8	8.22	10.65	6.99	3.81	11,175	1,360	5,100	479	......	0.4	1.5	4.4	14.2	10.4	8.3	15.9	14.8
8	New York	87	7.70	9.06	7.12	4.14	85,725	11,129	34,798	3,842	1.4	1.7	3.3	3.2	12.1	18.3	15.4	14.3	15.6
9	New Jersey	12	6.38	8.89	5.33	3.22	9,176	1,438	4,178	470	2.8	6.8	7.0	11.1	8.3	10.0	13.6	10.2	14.5
10	Pennsylvania	117	5.91	9.35	5.71	3.28	52,772	8,924	14,421	1,543	3.8	6.2	6.8	6.9	7.6	10.2	10.4	8.2	16.7
11	South Atlantic division	39	4.16	6.04	3.96	2.62	15,910	3,821	6,087	1,008	7.8	8.8	18.2	16.6	21.7	9.2	6.7	3.9	3.2
12	Virginia	8	4.62	7.19	4.08	2.56	5,240	1,133	2,122	295	2.0	3.1	8.1	25.1	21.0	13.2	10.5	4.4	5.4
13	North Carolina	18	3.78	5.99	3.53	2.56	4,839	1,281	1,760	294	11.2	11.2	14.0	12.3	25.5	6.1	5.8	6.1	4.1
14	South Carolina	8	3.91	4.79	3.90	2.78	3,373	863	1,359	284	13.0	14.4	32.4	10.6	20.1	3.5	2.1	1.4	1.0
15	Georgia	5	4.52	6.27	4.66	2.59	2,458	544	846	135	2.2	4.4	19.3	20.0	18.5	19.3	10.4	3.0	0.8
16	North Central division	62	5.70	9.38	5.21	3.05	32,957	5,781	8,373	893	2.1	2.8	7.1	5.4	9.0	10.4	10.1	14.4	14.3
17	Ohio	13	5.47	8.82	5.10	3.05	7,077	1,293	1,553	176	......	6.8	9.1	5.1	11.9	9.1	10.2	19.9	13.1
18	Illinois	7	7.02	10.29	5.87	2.72	5,108	728	2,161	210	......	3.8	5.2	4.8	1.4	8.1	8.1	10.5	21.9
19	Michigan	27	5.36	8.95	4.85	3.17	13,286	2,481	3,294	368	4.3	1.1	6.2	5.7	12.5	12.0	13.0	12.5	10.6
20	Wisconsin	12	5.22	9.94	4.89	3.08	4,454	854	1,044	105	2.9	1.0	5.7	7.6	6.7	11.4	3.8	18.1	16.2
21	Minnesota	3	7.13	9.44	7.02	1.33	3,032	425	321	34	......	......	20.6	......	8.8	11.8	8.8	20.6	8.8
22	South Central division	6	4.01	5.55	4.10	2.35	3,812	950	1,159	209	14.8	18.2	17.2	10.5	9.6	9.1	9.6	4.8	2.9
23	Tennessee	6	4.01	5.55	4.10	2.35	3,812	950	1,159	209	14.8	18.2	17.2	10.5	9.6	9.1	9.6	4.8	2.9
24	All other states	[2]14	4.63	6.20	4.44	2.35	3,437	742	1,010	163	25.2	14.7	6.7	8.0	10.4	4.3	6.1	4.9	8.0

IRON AND STEEL, BLAST FURNACES.

	STATE OR TERRITORY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total Earnings.	Total Number.	Men Earnings.	Men Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	82	$11.70	$11.71	$5.00	$5.33	$278,981	23,839	$278,752	23,796	1.5	0.7	1.1	1.1	2.3	5.0	4.9	10.7	31.0
2	North Atlantic division	35	12.03	12.05	......	5.68	140,228	11,657	140,035	11,623	0.2	0.2	0.3	0.8	1.7	3.8	3.5	12.7	32.8
3	New York	6	13.56	13.56	......	......	15,102	1,114	15,102	1,114	......	......	......	0.3	1.5	3.0	3.4	12.6	16.7
4	Pennsylvania	29	11.87	11.89	......	5.68	125,126	10,543	124,933	10,509	0.2	0.2	0.4	0.9	1.7	3.9	3.5	12.7	34.5
5	South Atlantic division	5	7.47	7.49	......	4.00	5,591	748	5,579	745	8.6	2.3	3.6	2.4	13.8	28.3	18.4	8.1	9.3
6	Virginia	5	7.47	7.49	......	4.00	5,591	748	5,579	745	8.6	2.3	3.6	2.4	13.8	28.3	18.4	8.1	9.3
7	North Central division	25	12.87	12.87	5.00	......	77,405	6,013	77,400	6,012	1.2	0.5	0.8	0.5	0.6	1.0	1.7	7.3	29.6
8	Ohio	17	13.01	13.01	5.00	......	64,835	4,984	64,830	4,983	1.4	0.4	0.8	0.6	0.6	1.0	1.9	6.8	27.7
9	Michigan	5	12.62	12.62	......	......	6,412	508	6,412	508	......	......	......	......	......	1.0	......	12.6	33.6
10	Wisconsin	3	11.82	11.82	......	......	6,158	521	6,158	521	0.4	2.3	1.1	0.4	1.0	1.7	1.3	6.7	43.4
11	South Central division	7	8.78	8.80	......	3.80	18,481	2,104	18,462	2,099	6.3	2.6	5.9	4.2	8.0	18.9	16.1	14.0	11.8
12	Tennessee	3	7.17	7.20	......	3.80	3,512	490	3,493	485	11.5	3.1	9.5	3.1	19.2	15.3	5.1	12.6	15.7
13	Alabama	4	9.27	9.27	......	......	14,969	1,614	14,969	1,614	4.8	2.4	4.8	4.5	4.6	20.0	19.4	14.4	10.7
14	All other states	[3]10	11.24	11.24	......	......	37,276	3,317	37,276	3,317	2.1	1.1	0.7	0.5	1.5	2.6	5.7	8.5	44.6

[1] Includes California, 1; Michigan, 1; Tennessee, 1; Virginia, 1.
[2] Includes California, 1; Delaware, 2; Idaho, 1; Indiana, 1; Kentucky, 1; Maine, 1; Maryland, 2; Nebraska, 1; Oregon, 1; Utah, 2; West Virginia, 1.

RIES, AND GEOGRAPHIC DIVISIONS—PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND OF ALL WAGE-EARNERS AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

GLASS.

MEN 16 YEARS AND OVER—continued.				WOMEN 16 YEARS AND OVER.													CHILDREN UNDER 16 YEARS.									
Per cent distribution of number by earnings—Continued.				Earnings.	Number.	Per cent distribution of number by earnings.											Earnings.	Number.	Per cent distribution of number by earnings.							
$12 to $15.	$15 to $20.	$20 to $25.	$25 and over			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
11.5	10.9	7.5	15.0	$8,738	1,721	9.9	21.7	25.0	14.7	11.7	6.7	3.5	2.9	1.7	1.4	0.8	$13,244	3,137	13.0	30.4	30.1	14.8	9.0	1.2	1.5	1
13.5	12.1	7.9	13.9	4,975	846	3.0	13.1	20.9	18.6	18.7	10.0	5.4	4.5	2.3	2.2	1.3	7,440	1,746	8.9	32.1	33.8	17.0	6.9	0.6	0.7	2
16.8	13.5	4.0	4.4	560	103	7.8	15.5	25.2	18.4	11.7	12.6	4.9	2.9	.....	1.0	.....	96	26	46.2	11.5	26.9	15.4	.....	.....	.....	3
11.6	8.3	10.7	12.5	494	94	1.1	.....	43.6	31.9	7.4	12.8	3.2	.....	.....	.....	.....	474	122	4.9	46.7	35.3	13.1	.....	.....	.....	4
3.8	7.7	3.7	26.8	139	34	.....	38.2	61.8	.....	.....	.....	.....	.....	.....	.....	.....	753	190	1.6	66.8	29.5	1.6	0.5	.....	.....	5
14.8	13.1	8.1	13.3	3,782	615	2.6	13.3	14.5	17.6	22.6	9.7	6.2	5.7	3.1	2.9	1.8	6,117	1,408	9.6	26.5	34.4	19.4	8.4	0.8	0.9	6
8.1	12.7	8.3	19.3	774	199	23.1	35.7	26.7	5.5	1.5	2.5	1.5	1.0	2.0	0.5	.....	834	264	39.8	30.3	22.7	5.7	1.5	.....	.....	7
3.3	8.9	2.2	25.7	43	12	16.7	33.3	41.7	8.3	.....	.....	.....	.....	.....	.....	.....	214	82	65.9	34.1	.....	.....	.....	.....	.....	8
9.6	13.9	10.2	17.3	731	187	23.5	35.8	25.7	5.4	1.6	2.7	1.6	1.1	2.1	0.5	.....	620	182	28.0	28.6	33.0	8.2	2.2	.....	.....	9
9.5	9.2	7.1	15.3	2,765	644	14.9	29.7	29.5	13.0	5.8	3.7	1.7	1.2	0.3	0.2	.....	4,774	1,067	11.7	26.5	27.3	13.9	15.0	2.4	3.2	10
6.1	11.2	6.3	21.2	1,406	283	2.5	22.6	38.9	13.1	8.8	7.1	3.5	2.5	0.7	0.3	.....	1,716	413	6.3	49.6	14.5	12.6	16.2	0.5	0.3	11
10.9	9.1	9.0	10.7	1,012	272	29.0	34.5	18.0	11.8	4.4	1.5	0.4	0.4	.....	.....	.....	2,090	447	21.5	15.4	20.6	10.7	19.5	4.9	7.4	12
5.5	3.7	0.6	35.0	108	28	25.0	28.6	.....	46.4	.....	.....	.....	.....	.....	.....	.....	808	172	1.8	2.9	67.4	27.9	.....	.....	.....	13
16.8	11.5	2.0	1.2	42	10	.....	.....	80.0	20.0	.....	.....	.....	.....	.....	.....	.....	152	33	.....	12.1	63.6	.....	18.2	6.1	.....	14
4.8	5.5	4.9	32.4	197	51	5.9	49.0	45.1	.....	.....	.....	.....	.....	.....	.....	.....	8	2	.....	.....	100.0	.....	.....	.....	.....	15
5.9	5.1	2.9	26.7	224	32	12.5	.....	34.4	3.1	12.5	6.3	.....	3.1	12.5	9.4	6.2	196	60	35.0	51.6	5.0	6.7	.....	1.7	.....	16

HOSIERY AND KNIT GOODS.

9.3	5.8	1.8	0.9	$177,317	29,502	7.3	10.2	15.0	16.2	17.3	14.1	8.7	6.1	3.6	1.3	0.2	$13,683	4,287	43.0	34.4	13.3	5.9	2.5	0.8	0.1	1
10.1	6.0	1.9	1.1	142,297	22,151	4.7	7.6	12.9	15.4	18.7	16.7	10.6	7.5	4.2	1.5	0.2	9,216	2,617	34.5	34.1	17.7	8.3	4.0	1.2	0.2	2
11.9	3.0	0.9	0.5	6,793	1,029	6.8	5.2	8.2	19.0	18.1	12.8	11.7	10.5	6.3	1.4	.....	66	28	67.9	17.8	10.7	3.6	.....	.....	.....	3
12.4	3.3	1.6	1.1	2,446	349	1.2	1.4	6.9	5.7	38.4	19.2	12.0	6.6	6.3	2.3	.....	31	10	30.0	20.0	40.0	.....	10.0	.....	.....	4
11.3	7.1	1.5	1.5	33,986	5,353	2.2	5.2	16.7	16.5	20.6	20.1	11.2	4.5	2.4	0.5	0.1	2,096	527	8.9	59.0	19.6	8.2	3.0	1.1	0.2	5
12.5	12.8	3.9	0.4	5,502	884	2.9	10.0	10.1	13.8	33.4	14.6	8.8	3.7	2.4	0.3	.....	242	71	36.6	43.7	18.3	1.4	.....	.....	.....	6
15.0	9.0	4.4	1.7	5,972	854	2.1	4.6	8.8	17.9	20.4	14.2	10.6	9.7	9.9	1.8	.....	103	27	7.4	40.7	48.2	3.7	.....	.....	.....	7
8.2	4.8	1.1	0.6	49,584	6,963	2.8	5.1	9.0	13.4	16.0	18.3	13.5	11.6	6.5	3.4	0.4	1,343	324	10.5	34.2	32.1	16.4	6.5	0.3	.....	8
8.5	4.0	1.7	1.5	4,747	890	12.7	10.7	17.4	16.6	24.9	7.8	4.7	3.9	1.1	0.2	.....	251	78	50.0	25.6	24.4	.....	.....	.....	.....	9
11.1	6.8	3.5	1.8	33,267	5,829	8.6	13.2	15.4	16.5	15.5	14.3	7.6	5.8	2.7	0.3	0.1	5,084	1,552	47.3	25.8	13.2	7.5	4.3	1.6	0.3	10
1.7	1.4	0.7	0.1	7,265	1,835	27.5	21.5	20.7	15.4	11.2	2.0	0.7	0.4	0.4	.....	0.2	2,558	978	56.0	36.4	4.7	2.3	0.4	0.2	.....	11
3.1	2.4	1.4	0.3	2,608	689	25.8	17.5	27.8	16.9	7.2	2.2	1.3	0.6	0.5	.....	0.2	510	199	61.8	27.2	6.0	3.5	0.5	1.0	.....	12
2.0	1.4	0.3	.....	2,008	569	33.9	33.0	12.5	7.9	11.8	0.5	.....	0.2	0.2	.....	.....	1,071	418	56.5	38.3	3.6	1.4	0.2	.....	.....	13
0.4	0.7	0.4	.....	1,405	360	29.7	17.2	15.8	20.0	14.2	1.9	0.6	.....	.....	.....	0.6	609	219	51.1	42.0	3.7	2.7	0.5	.....	.....	14
0.7	0.7	0.7	.....	1,244	267	14.6	12.4	27.3	21.7	15.7	4.9	1.1	0.8	1.5	.....	.....	368	142	54.2	35.2	7.8	2.1	0.7	.....	.....	15
10.9	10.9	2.2	0.4	23,356	4,486	8.6	15.2	21.3	20.6	14.8	8.6	4.4	2.8	2.6	1.0	0.1	1,228	402	35.8	49.5	11.7	2.7	0.3	.....	.....	16
4.0	6.8	2.9	1.1	5,274	1,035	5.9	22.9	27.2	18.7	9.1	6.5	3.5	3.0	2.4	0.8	.....	250	82	24.4	63.4	6.1	6.1	.....	.....	.....	17
18.6	16.2	0.9	0.5	2,868	480	0.6	10.8	16.2	20.0	21.9	12.7	8.0	5.1	3.5	0.8	0.4	79	29	37.9	51.7	10.4	.....	.....	.....	.....	18
11.4	9.0	1.4	0.3	9,526	1,966	13.5	14.5	20.1	22.7	14.3	7.4	3.4	1.9	1.5	0.6	0.1	466	147	44.9	29.9	20.4	4.1	0.7	.....	.....	19
7.6	13.3	5.7	.....	2,985	611	9.0	16.4	19.5	23.3	21.4	8.5	1.6	0.3	.....	.....	.....	425	138	29.7	63.8	6.5	.....	.....	.....	.....	20
2.9	11.8	5.9	.....	2,703	335	1.0	2.1	20.5	11.7	13.2	15.1	12.0	7.3	11.4	5.2	0.5	8	6	100.0	.....	.....	.....	.....	.....	.....	21
3.3	.....	.....	.....	2 134	520	25.9	25.6	25.2	13.1	8.1	1.3	0.8	.....	.....	.....	.....	519	221	82.3	11.8	5.0	0.9	.....	.....	.....	22
3.3	.....	.....	.....	2,134	520	25.9	25.6	25.2	13.1	8.1	1.3	0.8	.....	.....	.....	.....	519	221	82.3	11.8	5.0	0.9	.....	.....	.....	23
7.4	2.5	1.8	.....	2,265	510	16.5	23.3	21.6	17.6	11.5	6.5	1.2	1.4	0.4	.....	.....	162	69	92.8	5.8	1.4	.....	.....	.....	.....	24

IRON AND STEEL, BLAST FURNACES.

26.8	11.6	2.6	0.7	$5	1	.....	.....	.....	100.0	.....	.....	.....	.....	.....	.....	.....	$224	42	2.4	11.9	14.3	69.0	.....	.....	2.4	1
28.6	11.7	2.8	0.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	193	34	.....	.....	11.8	85.3	.....	.....	2.9	2
38.6	13.9	5.5	4.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3
27.5	11.4	2.5	0.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	193	34	.....	.....	11.8	85.3	.....	.....	2.9	4
4.0	1.1	0.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	3	33.3	.....	66.7	.....	.....	.....	.....	5
4.0	1.1	0.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	3	33.3	.....	66.7	.....	.....	.....	.....	6
34.5	18.2	3.7	0.4	5	1	.....	.....	.....	100.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7
33.9	20.0	4.5	0.4	5	1	.....	.....	.....	100.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8
38.4	13.6	0.2	0.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9
35.9	5.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10
7.1	3.0	1.4	0.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	19	5	.....	100.0	.....	.....	.....	.....	.....	11
2.9	1.6	0.2	0.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	19	5	.....	100.0	.....	.....	.....	.....	.....	12
8.4	3.4	1.7	0.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13
24.5	7.1	1.0	0.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	14

[3] Includes Connecticut, 1; Illinois, 2; Maryland, 2; Missouri, 1; New Jersey, 1; West Virginia, 3.

TABLE 71.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE SELECTED INDUSTRIES, BY STATES, TERRITO-
CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND AVERAGE WEEKLY EARNINGS, AND NUMBER

IRON AND STEEL, STEEL WORKS AND ROLLING MILLS.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS.				TOTAL.		MEN 16 YEARS AND OVER.										
			All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Earnings.	Number.	Earnings.	Number.	Per cent distribution of number by earnings.								
											Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	192	$12.45	$12.56	$5.95	$4.58	$1,482,872	119,069	$1,473,717	117,374	1.1	1.2	1.4	2.1	3.8	7.9	12.5	13.3	17.9
2	North Atlantic division	88	11.68	11.78	6.32	4.69	672,520	57,561	667,810	56,710	0.7	1.2	1.4	2.5	4.8	11.4	15.0	14.1	15.4
3	Massachusetts	3	11.69	11.85	6.99	4.60	59,330	5,077	58,279	4,918	(1)	(1)	0.2	1.6	4.1	10.7	12.9	12.0	19.6
4	Connecticut	3	10.29	10.60	5.15	4.09	17,559	1,706	17,081	1,611	1.9	1.8	6.0	3.0	3.9	6.9	18.1	11.5	15.3
5	New York	11	11.39	11.49	6.60	....	37,210	3,266	36,794	3,203	1.0	0.9	1.0	2.0	4.3	9.2	15.4	20.9	17.8
6	New Jersey	10	10.92	10.99	5.47	....	44,449	4,072	44,148	4,017	2.5	2.3	2.4	3.2	4.6	9.7	14.0	14.1	15.1
7	Pennsylvania	61	11.83	11.91	6.68	4.71	513,972	43,440	511,508	42,961	0.6	1.2	1.3	2.5	5.0	12.0	15.1	13.9	14.8
8	South Atlantic division	14	11.80	11.92	....	3.00	52,164	4,420	51,984	4,360	5.2	4.5	3.9	5.3	6.6	6.1	9.9	11.5	13.0
9	Delaware	5	7.87	8.05	....	3.00	13,294	1,690	13,114	1,630	5.9	7.8	7.6	12.5	12.6	9.1	11.0	7.1	14.5
10	West Virginia	9	14.24	14.24	....	....	38,870	2,730	38,870	2,730	4.8	2.5	1.7	1.0	3.1	4.2	9.3	14.2	12.0
11	North Central division	71	13.45	13.55	5.64	5.28	686,876	51,076	683,205	50,418	0.8	0.6	1.1	1.2	1.8	4.3	10.5	13.0	21.7
12	Ohio	35	13.71	13.81	5.62	5.40	344,603	25,139	342,887	24,830	0.3	0.3	0.7	1.0	1.4	3.9	11.4	12.4	19.6
13	Indiana	15	13.32	13.38	4.60	4.00	105,868	7,949	105,626	7,896	1.3	1.0	2.4	1.1	3.0	8.1	13.2	12.7	11.2
14	Illinois	13	13.29	13.43	5.84	4.64	204,190	15,368	202,490	15,074	1.1	0.7	0.9	1.4	1.7	2.8	6.0	13.2	31.6
15	Michigan	3	11.57	11.57	....	....	15,029	1,299	15,029	1,299	5.7	1.6	1.8	2.2	3.1	7.2	30.8	11.2	12.3
16	Wisconsin	5	13.01	13.02	....	6.50	17,186	1,321	17,173	1,319	......	0.4	0.2	0.9	1.5	2.5	10.2	24.5	20.3
17	South Central division	4	14.16	14.16	....	....	20,575	1,453	20,575	1,453	3.4	2.2	1.6	3.8	4.4	7.7	5.4	17.8	9.5
18	Kentucky	4	14.16	14.16	....	....	20,575	1,453	20,575	1,453	3.4	2.2	1.6	3.8	4.4	7.7	5.4	17.8	9.5
19	Western division	3	13.93	13.93	....	....	6,046	434	6,046	434	2.7	1.6	3.7	2.5	3.7	2.1	2.1	3.7	12.0
20	California	3	13.93	13.93	....	....	6,046	434	6,046	434	2.7	1.6	3.7	2.5	3.7	2.1	2.1	3.7	12.0
21	All other states	[1] 12	10.83	11.03	6.62	4.33	44,691	4,125	44,097	3,999	3.7	4.4	4.3	5.3	11.0	6.4	7.9	8.5	14.5

LEATHER, TANNED, CURRIED, AND FINISHED.

1	United States	621	$9.67	$9.90	$5.68	$4.08	$389,187	40,259	$379,076	38,293	1.4	1.2	2.7	3.5	6.8	10.0	11.8	17.9	21.7
2	North Atlantic division	356	9.75	9.95	5.54	3.94	252,155	25,851	247,535	24,869	1.3	1.2	2.4	3.3	6.3	9.7	12.4	18.7	22.0
3	Maine	11	9.27	9.34	8.00	3.00	2,096	226	2,082	223	......	1.4	1.4	2.2	4.0	17.0	4.5	38.1	17.0
4	New Hampshire	6	9.78	9.78	....	....	3,677	376	3,677	376	0.5	0.5	......	2.7	8.0	14.6	19.4	21.5	13.6
5	Massachusetts	119	9.84	9.91	6.23	3.34	99,078	10,064	98,306	9,921	1.2	1.2	2.8	4.4	7.0	9.8	11.3	17.8	22.1
6	Rhode Island	4	10.61	10.61	....	....	605	57	605	57	......	......	......	3.5	3.5	7.0	8.8	17.5	31.6
7	Connecticut	3	10.56	10.56	....	....	169	16	169	16	......	......	......	......	12.5	12.5	6.3	25.0	6.3
8	New York	61	9.57	9.67	4.77	....	34,743	3,631	34,390	3,557	1.2	1.3	3.4	2.9	4.4	8.1	11.8	25.1	20.1
9	New Jersey	31	12.65	12.83	5.62	4.43	24,775	1,959	24,552	1,913	0.1	0.4	0.2	2.1	1.4	7.0	6.6	14.4	21.1
10	Pennsylvania	121	9.14	9.51	5.48	3.97	87,012	9,522	83,754	8,806	1.9	1.5	2.2	2.6	7.2	10.6	14.9	17.5	23.2
11	South Atlantic division	100	8.00	8.66	5.75	4.61	34,030	4,256	28,855	3,332	3.2	2.5	3.6	6.8	12.1	15.3	12.1	10.6	20.6
12	Delaware	16	8.46	9.79	5.75	5.03	23,810	2,815	18,666	1,907	1.6	0.9	0.9	4.5	7.5	10.7	11.5	11.9	31.7
13	Maryland	9	9.39	9.39	....	....	291	31	291	31	......	......	......	3.2	......	9.7	6.5	41.9	35.5
14	Virginia	24	6.79	6.85	....	2.38	4,464	657	4,445	649	2.3	5.7	3.8	9.1	27.7	28.3	14.0	6.5	1.4
15	West Virginia	13	8.97	8.97	....	....	3,679	410	3,679	410	3.9	1.4	1.7	2.0	8.6	19.0	18.0	15.4	14.9
16	North Carolina	20	5.20	5.30	....	1.29	1,492	287	1,483	280	16.4	4.6	20.7	21.1	13.6	12.2	6.1	2.1	0.4
17	South Carolina	3	5.69	5.69	....	....	74	13	74	13	7.7	15.4	30.7	......	23.1	7.7	......	7.7	......
18	Georgia	15	5.12	5.17	....	3.00	220	43	217	42	2.4	21.4	19.0	28.6	7.1	14.3	......	4.8	......
19	North Central division	88	10.09	10.12	6.24	4.27	83,689	8,298	83,422	8,247	0.6	0.5	3.0	3.0	4.8	8.0	11.4	20.4	24.8
20	Ohio	25	11.08	11.13	5.00	4.67	16,583	1,496	16,531	1,485	1.2	0.9	1.3	1.8	2.4	4.2	9.4	19.5	28.9
21	Indiana	9	9.84	9.84	....	....	974	99	974	99	......	......	1.0	4.1	3.0	1.0	23.2	29.3	21.2
22	Illinois	11	9.59	9.60	....	4.33	22,914	2,389	22,901	2,386	0.2	0.4	4.5	5.8	9.6	10.9	12.7	17.0	19.2
23	Michigan	14	10.49	10.54	7.00	....	10,214	974	10,116	960	......	0.1	2.0	1.1	0.7	5.6	12.9	25.4	24.8
24	Wisconsin	15	9.75	9.79	5.33	4.00	30,086	3,087	29,982	3,064	0.7	0.5	3.3	2.3	3.7	9.1	11.1	22.9	26.8
25	Minnesota	5	9.59	9.59	....	....	163	17	163	17	......	......	......	......	5.9	5.9	29.4	11.8	29.4
26	Missouri	9	11.67	11.67	....	....	2,755	236	2,755	236	0.9	0.9	0.4	0.4	2.1	1.3	3.4	3.8	32.6
27	South Central division	34	7.97	7.97	....	....	5,413	679	5,413	679	1.3	1.9	4.1	2.5	23.7	28.4	11.7	12.2	6.6
28	Kentucky	10	9.21	9.21	....	....	1,971	214	1,971	214	0.9	1.4	1.4	0.9	4.2	27.6	22.4	14.5	12.2
29	Tennessee	21	7.37	7.37	....	....	3,339	453	3,339	453	1.6	2.2	5.1	3.3	33.3	29.1	6.8	10.6	3.8
30	Texas	3	8.58	8.58	....	....	103	12	103	12	......	......	16.7	......	8.3	16.7	......	33.3	16.7
31	Western division	34	13.61	13.61	....	....	12,072	887	12,072	887	0.6	0.6	0.4	1.0	1.0	1.7	1.0	5.3	6.8
32	Washington	3	14.50	14.50	....	....	116	8	116	8	......	......	......	......	......	......	......	......	12.5
33	Oregon	5	14.29	14.29	....	....	243	17	243	17	......	......	......	......	......	5.9	5.9	29.4	17.7
34	California	26	13.59	13.59	....	....	11,713	862	11,713	862	0.6	0.6	0.5	1.0	1.0	1.6	0.9	4.9	6.5
35	All other states	[2] 9	6.35	6.38	5.71	4.50	1,828	288	1,779	279	6.1	6.5	6.8	10.0	36.9	10.4	5.7	5.7	4.7

[1] Includes Alabama, 2; Kansas, 1; Maine, 1; Maryland, 2; Missouri, 2; Rhode Island, 1; Tennessee, 1; Virginia, 1; Washington, 1.

RIES, AND GEOGRAPHIC DIVISIONS—PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND OF ALL WAGE-EARNERS AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

IRON AND STEEL, STEEL WORKS AND ROLLING MILLS.

MEN 16 YEARS AND OVER—continued.				WOMEN 16 YEARS AND OVER.													CHILDREN UNDER 16 YEARS.									
Per cent distribution of number by earnings—Continued.				Earnings.	Number.	Per cent distribution of number by earnings.											Earnings.	Number.	Per cent distribution of number by earnings.							
$12 to $15.	$15 to $20.	$20 to $25.	$25 and over			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
15.9	12.7	4.6	5.6	$6,032	1,013	8.3	7.3	19.8	19.1	17.3	14.4	7.4	2.9	2.6	0.8	0.1	$3,123	682	14.4	19.9	28.5	16.1	14.5	4.8	1.8	1
14.0	11.8	3.9	3.8	2,787	441	2.9	7.0	22.5	19.5	17.0	14.1	8.8	3.6	3.6	0.5	0.5	1,923	410	12.4	16.3	35.6	19.3	8.3	5.9	2.2	2
21.2	14.6	2.6	0.5	936	134	0.8	3.0	13.4	23.9	13.4	15.7	16.4	4.4	8.2	0.8		115	25		16.0	64.0	8.0	8.0		4.0	3
15.5	12.4	2.6	1.1	433	84	10.7	22.6	20.2	15.5	8.3	13.1	7.2	2.4				45	11		18.2	81.8					4
12.7	6.9	4.2	3.7	416	63	3.2	11.1	6.4	9.5	27.0	20.6	7.9	6.4	7.9												5
14.7	12.1	3.2	2.1	301	55			72.7	20.0		7.3															6
13.2	11.8	4.1	4.5	701	105	1.0	1.0	19.0	22.8	31.4	12.4	5.7	3.8		1.0	1.9	1,763	374	13.6	16.3	32.4	20.6	8.6	6.4	2.1	7
10.1	8.3	5.6	10.0														180	60	30.0	51.7	18.3					8
6.3	3.8	1.3	0.5														180	60	30.0	51.7	18.3					9
12.3	10.9	8.2	15.8																							10
18.5	14.4	5.4	6.7	3,106	551	12.1	7.8	17.8	19.0	17.8	15.1	6.2	2.0	1.1	1.1		565	107		16.8	23.4	12.2	43.9	3.7		11
21.2	15.1	5.5	7.2	1,241	221	6.8	5.9	25.3	19.0	14.0	19.4	7.7	0.9	0.5	0.5		475	88		13.6	21.6	9.1	52.3	3.4		12
13.5	14.6	8.9	9.0	230	50	60.0	10.0	12.0	14.0				4.0				12	3		100.0						13
18.1	13.8	3.6	5.1	1,635	280	7.9	8.9	12.8	20.0	23.9	14.3	6.1	2.5	1.8	1.8		65	14		21.4	42.9	28.6	7.1			14
8.7	5.7	3.5	6.2																							15
15.0	15.9	4.3	4.3														13	2				50.0		50.0		16
13.4	3.3	2.1	25.4																							17
13.4	3.3	2.1	25.4																							18
26.3	21.0	14.5	4.1																							19
26.3	21.0	14.5	4.1																							20
15.4	11.0	3.3	4.3	139	21	19.1		19.1	9.5	9.5	4.7	9.5	9.5	19.1			455	105	27.6	19.1	11.4	17.1	17.1	4.8	2.9	21

LEATHER, TANNED, CURRIED, AND FINISHED.

14.4	6.9	1.2	0.5	$7,421	1,306	3.2	5.8	9.1	35.0	37.2	7.9	1.1	0.1	0.2	0.2	0.2	$2,690	660	13.8	22.6	36.7	20.4	6.5			1
13.9	6.9	1.3	0.6	2,594	468	4.5	10.1	16.9	23.9	31.4	10.1	1.9		0.2	0.4	0.6	2,026	514	14.0	27.4	35.2	15.4	8.0			2
8.5	5.4	0.5		8	1							100.0					6	[illegible]		100.0						3
12.0	5.8	1.1	0.3																							4
12.9	7.4	1.4	0.7	635	102	2.0	2.9	9.8	17.6	34.3	27.5	3.9		1.0	1.0		137	41	41.5	29.3	19.5	9.7				5
19.3	7.0	1.8																									6
37.4																										7
15.6	5.3	0.6	0.2	353	74	6.8	31.1	47.3	4.1	1.3	1.3	2.7			1.3	4.1										8
19.8	17.7	6.4	2.8	90	16				43.8	50.0	6.2						133	30			56.7	43.3				9
13.2	4.8	0.3	0.1	1,508	275	5.1	7.6	12.4	30.6	37.4	6.2	0.7					1,750	441	12.5	28.8	35.4	14.0	9.3			10
7.5	4.8	0.7	0.2	4,631	806	2.5	3.6	4.2	41.7	41.2	6.1	0.6		0.1			544	118	13.5		44.1	40.7	1.7			11
9.8	7.7	1.1	0.2	4,631	806	2.5	3.6	4.2	41.7	41.2	6.1	0.6		0.1			513	102			51.0	47.0	2.0			12
3.2																										13
0.8	0.2	0.2																19	[illegible]	100.0							14
11.7	2.5	0.2	0.7																							15
2.1	0.7																	[illegible]	7	100.0							16
7.7																										17
2.4																3	1	100.0							18
15.6	6.4	1.2	0.3	156	25	4.0		12.0	36.0	16.0	32.0						111	26	11.5	30.8	26.9	30.8				19
16.9	10.6	2.2	0.7	10	2	50.0				50.0							42	9		11.1	44.4	44.5				20
10.1	3.0	4.1																									21
12.7	5.7	1.0	0.3														13	3		100.0						22
20.3	5.7	1.3	0.1	98	14				21.4	21.4	57.2														23
14.3	4.6	0.6	0.1	48	9			33.3	66.7							56	14	21.4	28.6	21.4	28.6				24
5.9	11.7																									25
36.4	14.8	1.7	1.3																							26
4.9	2.1	0.6																								27
10.8	2.8	0.9																								28
2.2	1.6	0.4																								29
	8.3																									30
53.7	23.9	3.0	1.0																							31
	87.5																									32
23.5	11.8	5.8																								33
54.8	23.6	3.0	1.0																							34
4.3	2.5		0.4	40	7			42.9		42.8			14.3				9	[illegible]			100.0					35

[2] Includes Alabama, 2; Colorado, 1; Iowa, 1; Mississippi, 2; North Dakota, 1; South Dakota, 1; Utah, 1.

TABLE 71.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE SELECTED INDUSTRIES, BY STATES, TERRITO- CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND AVERAGE WEEKLY EARNINGS, AND NUMBER

LUMBER AND TIMBER PRODUCTS.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS.				TOTAL.		MEN 16 YEARS AND OVER.										
			All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Earnings.	Number.	Earnings.	Number.	Per cent distribution of number by earnings.								
											Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	8,394	$9.21	$9.25	$5.22	$3.59	$1,630,913	177,022	$1,625,738	175,718	4.6	2.9	4.8	4.4	10.9	11.3	7.3	19.0	12.8
2	North Atlantic division	2,160	9.58	9.60	5.93	3.71	268,493	28,026	267,812	27,888	0.7	0.6	0.9	1.1	6.6	10.9	10.0	34.0	16.6
3	Maine	388	9.30	9.31	6.00	4.27	82,230	8,842	82,130	8,821	0.7	0.5	0.7	1.1	8.4	9.8	10.8	36.8	17.3
4	New Hampshire	141	9.83	9.84	6.50		11,954	1,216	11,941	1,214	0.2	0.1	1.1	0.9	4.2	9.1	7.9	40.2	20.2
5	Vermont	164	8.86	8.90	5.89	2.83	15,673	1,768	15,603	1,753	0.3	0.4	0.4	0.4	6.3	16.1	11.6	46.4	10.3
6	Massachusetts	257	10.13	10.16	7.16	4.60	29,259	2,887	29,100	2,863		0.1	(1)	0.2	2.4	6.5	7.5	34.1	24.1
7	Rhode Island	16	10.00	10.00			2,101	210	2,101	210				1.4	1.0	2.9	1.4	59.5	10.0
8	Connecticut	62	10.24	10.24			4,834	472	4,834	472	1.0			1.3	1.5	2.5	1.1	33.9	37.1
9	New York	463	9.59	9.61	5.46	2.83	46,372	4,836	46,284	4,817	0.6	0.7	1.2	1.0	7.7	14.1	8.2	35.1	16.4
10	New Jersey	63	8.51	8.51		6.00	3,615	425	3,609	424	1.4	0.5	1.4	2.1	12.5	26.4	4.5	29.0	11.3
11	Pennsylvania	606	9.83	9.87	5.26	3.55	72,455	7,370	72,210	7,314	1.3	0.9	1.3	1.7	6.1	10.9	12.2	25.3	12.9
12	South Atlantic division	1,819	6.46	6.49	5.00	3.12	207,194	32,060	206,227	31,759	8.6	7.5	14.5	12.1	21.4	13.3	4.8	7.6	4.5
13	Delaware	25	5.56	5.56			1,145	206	1,145	206	7.3	4.4	15.5	15.0	45.6	1.5	0.5	8.2	1.5
14	Maryland	102	6.35	6.38		3.62	4,063	640	4,034	632	3.0	4.4	12.0	21.8	27.7	12.0	2.9	10.0	2.2
15	Virginia	291	6.66	6.74		3.57	28,503	4,278	28,150	4,179	4.3	4.9	6.9	16.5	31.4	17.6	2.6	6.9	3.3
16	West Virginia	321	9.16	9.18	6.67	4.67	47,414	5,174	47,310	5,153	4.2	2.2	2.5	4.1	9.2	9.9	9.4	26.1	15.9
17	North Carolina	523	5.37	5.40	2.50	2.65	43,507	8,097	43,330	8,030	12.8	11.3	23.6	13.0	21.5	7.9	3.3	2.7	1.6
18	South Carolina	190	4.72	4.74		2.42	14,298	3,028	14,235	3,002	18.9	18.7	28.3	10.5	10.5	3.9	2.8	3.3	0.9
19	Georgia	330	6.02	6.05		2.72	47,270	7,848	47,107	7,788	7.1	6.5	16.5	16.8	27.6	11.7	5.1	3.5	2.1
20	Florida	37	7.53	7.55	5.00	2.80	20,994	2,789	20,916	2,769	5.1	2.2	2.1	3.9	19.7	45.0	6.1	4.6	4.8
21	North Central division	1,873	9.79	9.84	4.53	4.17	458,406	46,825	456,756	46,440	1.3	1.2	1.5	1.8	5.7	10.2	9.9	29.2	20.5
22	Ohio	506	8.91	8.93	4.17	2.17	41,763	4,686	41,700	4,668	3.4	1.4	2.1	2.5	7.7	13.9	7.6	35.5	12.4
23	Indiana	501	8.62	8.65	5.93	3.89	44,119	5,119	43,927	5,077	2.2	1.9	2.4	3.3	11.9	22.1	10.1	25.7	7.5
24	Illinois	149	8.09	8.12	7.50	3.55	19,126	2,363	19,072	2,350	3.6	3.1	5.2	3.8	14.7	22.6	17.2	15.0	5.5
25	Michigan	318	10.26	10.30	5.07	4.33	186,064	18,128	185,459	17,998	0.1	0.5	0.6	0.6	3.4	6.0	9.4	36.5	23.9
26	Wisconsin	145	10.13	10.17	3.86	4.22	80,231	7,924	80,010	7,871	0.1	1.1	1.1	2.3	2.8	8.9	11.6	25.6	26.4
27	Minnesota	[illegible]	11.34	11.34	3.00		50,741	4,475	50,738	4,474	2.6	0.9	1.2	0.8	1.8	2.1	3.3	15.8	35.1
28	Iowa	23	9.93	10.24		4.35	10,390	1,046	10,151	991	0.1	0.8	0.2	0.5	4.0	6.3	9.7	33.7	26.3
29	Missouri	155	8.13	8.24	3.00	4.26	23,958	2,947	23,685	2,874	3.3	3.1	3.5	4.4	12.6	18.1	16.8	21.9	8.1
30	South Dakota	4	15.54	15.54			1,865	120	1,865	120									
31	Kansas	3	8.76	8.76			149	17	149	17					11.7	5.9		76.5	
32	South Central division	1,850	7.78	7.82	3.17	3.28	354,151	45,502	353,005	45,151	9.2	4.2	6.1	5.7	16.7	16.9	6.7	14.1	8.0
33	Kentucky	424	6.84	6.91	3.40	2.85	31,876	4,660	31,648	4,581	4.6	4.6	9.6	8.3	28.6	20.8	6.5	7.9	3.0
34	Tennessee	480	6.88	6.94	2.72	2.75	43,838	6,371	43,600	6,284	5.2	4.9	9.0	5.8	33.0	20.4	3.7	7.6	3.7
35	Alabama	221	6.55	6.58		2.62	23,308	3,558	23,232	3,529	5.4	3.4	10.3	13.4	31.1	21.7	3.4	4.1	2.3
36	Mississippi	198	8.28	8.32	3.60	3.98	45,592	5,503	45,407	5,456	2.0	3.0	2.2	3.1	19.8	28.7	3.1	21.4	5.9
37	Louisiana	64	9.63	9.67		5.14	57,448	5,964	57,227	5,921	3.8	3.4	3.0	2.5	6.7	13.8	11.6	20.0	14.2
38	Arkansas	335	7.63	7.66	6.00	2.81	83,663	10,961	83,465	10,895	13.8	4.9	6.6	6.6	11.0	12.5	9.5	14.9	8.8
39	Indian Territory	31	9.53	9.53			2,515	264	2,515	264			0.4	0.8	1.1	35.6	4.2	33.7	6.8
40	Texas	97	8.02	8.02			65,911	8,221	65,911	8,221	19.1	4.5	4.2	4.0	4.8	9.3	6.0	16.4	12.3
41	Western division	686	13.92	13.97	8.29	4.40	339,961	24,429	339,230	24,300	1.4	0.6	0.5	0.8	1.5	1.2	3.4	5.9	13.5
42	Montana	7	14.58	14.58			15,383	1,055	15,383	1,055	0.8	0.4	0.3	0.7	0.7		0.4	0.2	1.1
43	Idaho	22	14.10	14.16	4.25		9,419	668	9,402	664					1.2	1.1	0.9	2.7	3.6
44	Wyoming	11	21.44	21.48	6.00		8,706	406	8,700	405								0.5	
45	Colorado	34	13.78	13.82	9.67	12.00	9,026	655	8,956	648	0.3		1.2		0.3	0.9	0.6	12.8	10.4
46	New Mexico	[illegible]	9.32	9.60		2.92	8,431	905	8,320	867	8.6	3.3	2.7	5.3	10.5	5.9	10.4	18.9	12.5
47	Arizona	4	14.52	14.53		9.00	8,158	562	8,149	561							1.8	1.8	13.2
48	Utah	18	14.06	14.43	3.00	9.00	1,097	78	1,082	75								6.7	1.3
49	Washington	344	13.64	13.65		6.00	137,177	10,055	137,135	10,048	1.9	0.8	0.7	1.8	1.1	1.8	5.6	6.1	16.1
50	Oregon	116	12.30	12.33	6.00	7.20	38,005	3,091	37,873	3,071	1.8	0.8	0.5	1.8	2.8	0.4	1.7	7.9	20.7
51	California	124	15.04	15.09	10.58	4.41	104,559	6,954	104,230	6,906	0.2	0.1	0.2	0.2	1.0	0.3	1.3	4.2	10.6
52	All other states	[2]6	15.04	15.04			2,708	180	2,708	180	3.3	1.1	1.1	0.6	0.6	5.0	1.1	2.8	1.7

LUMBER, PLANING MILL PRODUCTS, INCLUDING SASH, DOORS, AND BLINDS.

	STATE OR TERRITORY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	2,866	$11.05	$11.15	$5.18	$3.65	$561,392	50,787	$558,392	50,067	1.8	2.1	3.7	4.0	7.1	7.1	5.8	13.7	12.1
2	North Atlantic division	1,046	12.09	12.16	5.95	3.53	217,167	17,967	216,231	17,782	0.7	1.2	2.1	2.4	4.4	6.2	5.5	14.0	13.8
3	Maine	44	10.79	10.79			4,112	381	4,112	381	1.1	0.8	1.1		4.7	8.4	5.2	24.4	9.2
4	New Hampshire	28	9.50	9.58	6.09		4,713	496	4,646	485	0.4	1.5	0.8	0.6	4.1	10.3	13.4	36.1	15.5
5	Vermont	32	8.03	8.26	5.60	3.46	7,714	961	7,322	886	2.4	2.5	4.3	6.0	11.7	27.9	7.3	17.6	8.2
6	Massachusetts	181	12.77	12.81	7.00	3.80	45,871	3,591	45,791	3,575	0.3	0.3	1.0	1.5	3.2	2.7	3.6	9.9	18.1
7	Rhode Island	16	11.70	11.70			3,930	336	3,930	336	2.1	3.6	2.7	1.5	4.7	4.2	5.0	7.7	14.9
8	Connecticut	35	12.82	12.82			6,024	470	6,024	470	0.2	0.2	1.5	0.9	1.9	5.5	8.5	10.7	11.3
9	New York	308	12.37	12.40	6.90	3.79	85,098	6,880	84,907	6,846	0.8	1.5	2.6	2.8	4.5	5.8	6.4	13.0	12.9
10	New Jersey	63	12.23	12.26	10.00	4.00	13,393	1,095	13,371	1,091		1.7	1.8	2.6	2.6	2.8	2.7	16.1	12.6
11	Pennsylvania	339	12.33	12.43	5.41	3.29	46,312	3,757	46,128	3,712	0.7	1.2	2.4	2.3	4.4	5.8	4.9	15.4	13.3
12	South Atlantic division	357	7.21	7.30	4.50	2.62	46,949	6,514	46,592	6,385	6.9	6.9	13.4	12.8	18.5	8.2	4.8	9.0	5.8
13	Delaware	7	6.61	6.61			1,012	153	1,012	153	7.9	6.5	5.2	17.7	29.4	9.8	3.9	9.8	4.6
14	Maryland	30	8.67	8.74		3.33	7,446	859	7,406	847	6.5	4.8	5.6	13.2	12.0	6.5	6.6	12.0	11.1
15	Virginia	53	7.22	7.40	4.50	2.04	6,120	848	6,026	814	5.5	5.7	11.2	10.9	24.3	10.8	3.3	7.8	7.0
16	West Virginia	84	9.64	9.72		4.45	6,864	712	6,815	701	2.1	3.3	2.1	2.3	8.7	9.3	9.7	26.7	9.6
17	North Carolina	67	5.87	5.97		2.22	7,130	1,215	7,059	1,183	5.8	6.3	26.0	15.6	17.9	11.6	4.6	5.8	2.7
18	South Carolina	39	6.01	6.03		3.60	4,790	797	4,772	792	14.3	15.8	13.5	11.0	19.8	4.0	2.5	5.7	3.5
19	Georgia	66	7.01	7.10		2.31	11,558	1,648	11,491	1,619	7.7	7.2	15.8	15.1	19.6	6.8	3.2	4.9	4.5
20	Florida	11	7.20	7.29		3.00	2,029	282	2,011	276	2.2	2.2	9.8	20.3	31.5	6.5	8.0	5.1	5.4

[1] Less than one-tenth of 1 per cent.

RIES, AND GEOGRAPHIC DIVISIONS—PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND OF ALL WAGE-EARNERS AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

LUMBER AND TIMBER PRODUCTS.

MEN 16 YEARS AND OVER—continued.				WOMEN 16 YEARS AND OVER.													CHILDREN UNDER 16 YEARS.									
Per cent distribution of number by earnings—Continued.				Earnings.	Number.	Per cent distribution of number by earnings.											Earnings.	Number.	Per cent distribution of number by earnings.							
$12 to $15.	$15 to $20.	$20 to $25.	$25 and over			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
12.1	7.0	1.9	1.0	$1,577	302	16.2	18.9	13.2	14.2	16.6	9.3	1.0	4.3	1.7	3.6	1.0	$3,598	1,002	33.0	32.4	21.1	5.1	5.0	2.0	1.4	1
13.0	4.4	0.9	0.3	451	76	6.6	13.2	14.5	13.2	15.8	19.7	2.6	13.1		1.3		230	62	35.5	35.5	9.7	4.8	14.5			2
9.8	3.6	0.4	0.1	36	6			16.7		66.7	16.6						64	15	20.0	20.0	13.3	20.0	26.7			3
9.9	4.9	1.2	0.1	13	2				50.0		50.0															4
5.9	1.7	0.2		53	9				11.1	88.9							17	[illegible]	33.3	66.7						5
16.9	6.2	1.0	1.0	136	19		15.8	21.0			5.3	5.3	52.6				23	5		20.0	60.0		20.0			6
19.5	4.3																									7
15.5	5.5	0.6																								8
7.1	5.6	1.9	0.4	71	13	7.6		38.5	15.4		38.5						17	6	50.0	50.0						9
9.9	1.0																[illegible]	1					100.0			10
21.5	4.6	0.9	0.4	142	27	14.8	26.0	3.7	22.2		25.9	3.7			3.7		103	29	48.3	37.9	3.5		10.3			11
3.3	1.6	0.5	0.3	75	15	6.7		6.7	66.6	6.7	13.3						892	286	42.7	40.9	12.6	2.1	0.7	1.0		12
0.5																										13
3.0	1.0																29	8	25.0	25.0	25.0	25.0				14
3.2	1.4	0.6	0.4														353	99	15.2	60.6	23.2	1.0				15
11.0	4.3	0.8	0.4	20	[illegible]					33.3	66.7						84	18		44.4	16.7	11.1	11.1	16.7		16
1.1	0.7	0.3	0.2	5	2	50.0		50.0									172	65	69.2	30.8						17
0.9	0.9	0.2	0.2														63	26	84.6	15.4						18
1.6	0.8	0.4	0.3														163	60	60.0	25.0	13.3	1.7				19
3.2	2.0	0.5	0.8	50	10				100.0								28	10	20.0	80.0						20
11.9	4.9	1.1	0.8	557	123	17.9	21.1	14.6	17.1	22.0	3.3	0.8	1.6	0.8	0.8		1,093	262	11.4	34.0	30.2	10.3	9.9	2.3	1.9	21
9.3	3.2	0.6	0.4	50	12		41.7	33.3	25.0								13	5	100.0							22
7.4	4.1	1.1	0.3	83	14			7.2		85.7	7.1						109	28	14.3	35.7	46.4		3.6			23
4.8	3.3	0.9	0.3	15	2						100.0						39	11	27.3	27.3	45.4					24
11.9	5.0	1.5	0.6	289	57	17.5		22.8	24.6	26.3	1.8	1.8	1.8	1.7	1.7		316	73	9.6	24.7	39.8	9.6	6.8	6.8	2.7	25
13.7	4.6	0.8	1.0	27	7		42.9		57.1								194	46		43.5	34.8	13.0	8.7			26
24.9	8.6	0.8	2.1	3	1		100.0																			27
10.8	5.4	1.2	1.0														239	55	1.8	43.7	18.2	25.5	10.8			28
4.4	2.7	0.5	0.6	90	30	40.0	56.7						3.3				183	43	21.0	32.5	13.9		23.3	2.3	7.0	29
51.7	45.0	2.5	0.8																							30
5.9																										31
6.9	3.7	0.9	0.9	146	46	45.6	34.8	8.7		10.9							1,000	305	43.3	23.9	24.9	4.3	0.3	2.6	0.7	32
3.4	1.5	0.7	0.5	17	5	40.0	20.0	40.0									211	74	48.6	31.1	18.9	1.4				33
3.6	2.1	0.6	0.4	87	32	50.0	46.9	3.1									151	55	56.4	21.8	20.0	1.8				34
2.8	1.4	0.5	0.2														76	29	89.7	6.9	3.4					35
5.9	3.4	0.7	0.8	18	5	60.0		20.0		20.0							167	42	19.1	21.4	59.5					36
11.6	7.0	1.3	1.1														221	43		16.3	48.8	11.6	2.3	16.3	4.7	37
6.5	3.4	0.7	0.8	24	4					100.0							174	62	50.0	32.3	6.4	9.7		1.6		38
10.6	5.7	1.1																								39
11.0	5.6	1.2	1.6																							40
32.6	27.0	8.3	3.3	348	42		11.9	14.3	4.8	11.9	16.7		2.4	9.5	21.4	7.1	383	87	28.7	27.6	16.1	2.3	13.8	3.5	8.0	41
64.7	19.9	7.1	3.7																							42
53.9	29.5	5.0	2.1	17	4			100.0																		43
8.2	0.2	91.1		6	1					100.0																44
32.6	36.4	2.8	1.7	58	6				16.6	16.7				16.7	50.0		12	1							100.0	45
9.3	7.0	2.1	3.5														111	38	47.4	42.1	10.5					46
29.2	43.7	6.2	4.1														9	1							100.0	47
33.3	48.0	10.7		6	2		100.0										9	1							100.0	48
27.9	25.7	8.5	3.0														42	7	14.3				57.1	14.3	14.3	49
38.6	18.5	3.2	1.3	50	10		20.0	20.0	10.0	10.0	30.0		10.0				72	10			10.0		40.0	20.0	30.0	50
34.5	35.3	7.3	4.8	201	19		5.3			10.5	21.0			15.8	31.6	15.8	128	29	20.7	27.6	31.0	6.9	13.8			51
22.2	49.4	7.8	3.3																							52

LUMBER, PLANING MILL PRODUCTS, INCLUDING SASH, DOORS, AND BLINDS.

18.5	18.9	4.6	0.6	$1,254	242	12.4	12.0	24.4	10.7	28.9	5.4	2.9	1.2	1.7	0.4		$1,746	478	23.0	33.1	29.1	10.9	2.7	0.8	0.4	1
17.9	25.1	6.0	0.7	696	117	6.8	8.5	23.1	13.7	26.5	10.3	5.1	2.6	2.6	0.8		240	68	23.5	44.1	23.5	7.4	1.5			2
29.9	14.4	0.8																								3
13.4	3.7	0.2		67	11					90.9	9.1															4
7.2	4.8	0.1		347	62	11.3	16.1	16.1	19.3	19.4	9.7	8.1					45	13	46.1	15.4	23.1	15.4				5
20.3	34.3	4.5	0.3	42	6				33.3	50.0					16.7		38	10	10.0	20.0	50.0	20.0				6
28.9	23.5	1.2																								7
17.0	38.9	2.8	0.6																							8
18.0	23.5	7.1	1.1	138	20			25.0	10.0	25.0	20.0	5.0	10.0	5.0			53	14	14.3	50.0	28.6	7.1				9
12.6	42.7	1.6	0.2	10	1									100.0			12	3			100.0					10
17.8	21.1	9.9	0.8	92	17	5.9		70.6		5.9	5.9		5.9	5.8			92	28	25.0	67.8	3.6		3.6			11
7.8	5.2	0.6	0.1	45	10			100.0									312	119	60.5	24.4	11.8	0.8	2.5			12
1.3	3.9																									13
11.6	8.9	0.8	0.4														40	12	25.0	33.3	33.3		8.4			14
8.4	5.0	0.1		45	10			100.0									49	24	91.6	4.2	4.2					15
12.6	12.4	1.1	0.1														49	11		27.3	45.4	9.1	18.2			16
2.4	1.0	0.1	0.2														71	32	78.1	21.9						17
6.6	2.9	0.4															18	5	20.0	20.0	60.0					18
9.3	5.1	0.7	0.1														67	29	65.5	31.0	3.5					19
4.3	2.9	1.8															18	6	33.3	66.7						20

[2] Includes Alaska, 1; Nebraska, 2; Nevada, 2; Oklahoma, 1.

TABLE 71.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE SELECTED INDUSTRIES, BY STATES, TERRITO- CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND AVERAGE WEEKLY EARNINGS, AND NUMBER

LUMBER, PLANING MILL PRODUCTS, INCLUDING SASH, DOORS, AND BLINDS—Continued.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
21	North Central division	937	$11.12	$11.23	$4.39	$4.25	$189,523	17,048	$188,318	16,768	0.7	1.2	2.1	2.5	4.4	6.2	7.7	17.5	14.8
22	Ohio	273	10.78	10.91	3.37	4.57	43,003	3,989	42,705	3,913	1.1	1.6	2.8	3.6	4.2	6.6	8.9	15.6	13.4
23	Indiana	131	11.33	11.36	2.00	4.00	16,855	1,487	16,843	1,483	1.6	1.0	1.4	1.4	3.6	6.1	7.5	16.7	12.8
24	Illinois	133	12.90	12.96	7.00	4.50	38,959	3,021	38,841	2,997	0.5	0.5	1.2	1.8	2.5	3.9	3.0	9.8	14.3
25	Michigan	154	9.77	9.90	4.15	4.40	30,269	3,098	29,972	3,029	0.1	0.6	1.6	2.4	6.6	6.0	10.6	35.1	14.3
26	Wisconsin	64	10.99	11.14	3.50	4.38	12,878	1,172	12,772	1,147	0.3	0.9	1.6	2.7	3.3	6.8	7.1	16.3	19.8
27	Minnesota	47	10.45	10.64	6.04	3.88	13,203	1,263	12,978	1,220	0.5	1.1	2.4	2.9	4.6	5.1	7.9	17.5	22.7
28	Iowa	43	10.23	10.37	6.00	3.20	11,192	1,094	11,122	1,073	0.4	3.8	4.2	2.2	6.9	10.0	14.8	11.3	12.6
29	Missouri	51	12.14	12.22	......	4.14	16,558	1,364	16,500	1,350	1.0	1.6	2.1	2.0	3.8	6.2	5.3	10.9	15.1
30	South Dakota	7	13.92	13.92	......	......	334	24	334	24	......	......	......	......	4.2	......	......	......	......
31	Nebraska	14	12.77	13.01	......	5.33	1,200	94	1,184	91	......	......	......	1.1	5.5	5.5	......	6.6	13.2
32	Kansas	20	11.48	11.49	5.00	......	5,072	442	5,067	441	3.4	1.8	2.7	1.8	3.2	12.9	3.2	9.1	10.7
33	South Central division	269	9.20	9.26	3.50	3.50	42,224	4,592	42,028	4,536	3.6	2.8	4.2	5.8	15.5	15.8	5.8	11.5	7.2
34	Kentucky	64	8.91	8.97	......	3.75	11,989	1,346	11,929	1,330	3.5	2.6	4.6	6.8	16.4	12.3	5.8	10.7	9.8
35	Tennessee	40	8.72	8.84	......	3.31	6,312	724	6,259	708	4.9	5.1	4.9	7.1	21.9	10.9	3.7	8.8	7.6
36	Alabama	33	7.70	7.82	......	3.00	2,463	320	2,439	312	0.6	2.2	6.1	6.1	35.9	14.7	4.5	10.3	7.4
37	Mississippi	20	8.58	8.58	......	......	2,926	341	2,926	341	2.0	0.9	4.7	8.8	17.3	30.8	1.5	8.2	2.6
38	Louisiana	[illegible]	10.74	10.74	......	......	2,277	212	2,277	212	4.3	1.9	4.2	0.5	3.8	12.7	3.8	16.5	3.3
39	Arkansas	45	8.95	8.95	......	4.50	9,554	1,068	9,545	1,066	4.4	2.2	2.2	4.8	11.4	24.2	10.6	15.4	7.0
40	Indian Territory	7	14.92	14.92	......	......	537	36	537	36	......	......	......	......	2.8	2.8	......	11.1	......
41	Oklahoma	7	14.71	14.71	......	......	721	[illegible]	721	49	......	......	......	......	......	......	......	10.2	6.1
42	Texas	44	10.98	11.19	3.50	3.58	5,445	496	5,395	482	3.5	3.5	5.6	4.6	6.0	7.9	4.2	10.2	5.6
43	Western division	248	14.11	14.26	6.00	4.21	62,798	4,451	62,505	4,384	1.2	0.6	1.4	1.4	3.2	3.6	1.7	7.8	9.6
44	Idaho	5	15.50	15.91	......	6.00	372	24	366	23	......	......	......	......	......	......	......	4.4	......
45	Wyoming	3	18.50	18.50	......	......	185	10	185	10	......	......	......	......	......	......	......	......	......
46	Colorado	10	15.49	15.49	......	......	1,239	80	1,239	80	......	......	......	......	......	5.0	2.5	7.5	6.2
47	New Mexico	7	16.71	16.71	......	......	568	34	568	34	......	......	......	......	5.9	2.9	......	5.9	......
48	Washington	41	12.72	12.73	......	3.00	13,761	1,082	13,758	1,081	0.7	0.5	2.2	1.3	2.9	3.3	3.0	8.5	12.3
49	Oregon	37	13.50	13.51	6.00	......	7,627	565	7,621	564	1.2	1.4	1.6	1.3	4.6	3.9	3.0	8.5	6.4
50	California	145	14.70	14.96	6.00	4.20	39,046	2,656	38,768	2,592	1.5	0.6	1.1	1.6	3.0	3.6	0.9	7.5	9.5
51	All other states	[2]9	12.70	12.82	......	4.33	2,731	215	2,718	212	2.4	0.9	1.9	1.9	4.2	10.8	2.4	6.1	3.8

PAPER AND WOOD PULP.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	381	$9.81	$10.64	$5.85	$4.86	$375,759	38,294	$337,546	31,735	2.1	1.2	1.6	1.8	3.7	7.0	9.5	24.6	19.9
2	North Atlantic division	280	9.86	10.73	5.95	4.89	281,700	28,580	251,034	23,401	2.3	1.1	1.4	1.6	3.5	6.7	9.7	24.6	19.6
3	Maine	16	11.24	11.38	6.11	5.00	32,954	2,931	32,504	2,857	2.6	1.1	1.6	1.6	2.2	3.3	6.4	19.5	20.6
4	New Hampshire	5	10.03	10.31	5.83	......	953	95	918	89	......	......	......	3.4	4.5	12.4	19.1	19.1	14.6
5	Vermont	13	10.08	10.30	5.84	8.00	9,511	944	9,192	892	5.3	3.2	1.8	0.9	4.3	4.6	8.8	22.9	20.3
6	Massachusetts	83	9.43	11.24	6.13	5.14	109,151	11,581	84,103	7,480	0.7	0.5	0.8	1.1	3.0	4.8	9.9	28.1	19.4
7	Connecticut	28	9.95	10.85	5.42	5.00	11,348	1,141	10,320	951	1.9	0.2	1.3	2.0	5.4	9.4	12.2	17.7	15.0
8	New York	81	10.11	10.28	5.12	3.32	80,967	8,009	79,666	7,748	3.5	1.7	2.0	1.9	4.1	7.6	8.0	25.6	20.0
9	New Jersey	19	10.25	10.59	5.21	......	7,044	687	6,820	644	0.9	1.1	1.9	3.3	5.9	9.1	16.5	21.7	14.0
10	Pennsylvania	35	9.33	10.04	5.03	4.26	29,772	3,192	27,511	2,740	2.9	0.7	1.1	1.8	2.8	11.8	15.3	21.0	20.5
11	South Atlantic division	10	9.02	9.72	4.97	4.00	5,883	652	5,407	556	0.4	0.4	0.2	0.4	1.8	31.5	20.1	9.7	9.0
12	Delaware	3	9.08	10.34	4.98	......	3,587	395	3,124	302	0.7	0.7	0.3	0.7	2.3	6.3	28.5	14.9	16.2
13	Maryland	7	8.93	8.99	4.50	4.00	2,296	257	2,283	254	......	......	......	......	1.2	61.4	10.3	3.5	0.4
14	North Central division	75	9.37	10.12	5.56	4.52	67,637	7,216	61,139	6,044	1.1	1.4	2.1	2.5	5.3	5.8	9.7	29.0	19.9
15	Ohio	27	9.43	10.34	5.47	......	25,483	2,703	22,721	2,198	0.9	1.4	2.4	3.3	3.4	6.1	8.2	28.1	21.2
16	Indiana	17	9.24	9.79	4.65	3.25	9,868	1,068	9,354	955	3.0	1.7	2.6	2.5	6.9	9.2	15.5	23.6	13.9
17	Illinois	7	10.25	10.37	5.50	......	5,885	574	5,808	560	3.6	2.1	0.7	2.0	2.7	2.0	8.0	20.9	33.4
18	Michigan	15	9.37	10.12	6.23	4.86	13,808	1,474	12,062	1,192	0.1	0.8	2.1	2.5	6.8	6.3	12.1	33.0	12.6
19	Wisconsin	[illegible]	9.01	9.83	5.42	5.50	12,593	1,397	11,194	1,139	......	1.6	1.4	1.5	7.3	3.8	7.8	35.1	23.4
20	Western division	3	14.02	14.35	6.83	......	3,870	276	3,788	264	......	......	0.8	0.4	0.8	0.8	4.2	15.1	18.9
21	California	3	14.02	14.35	6.83	......	3,870	276	3,788	264	......	......	0.8	0.4	0.8	0.8	4.2	15.1	18.9
22	All other states	[3]13	10.62	11.01	4.88	5.00	16,669	1,570	16,178	1,470	3.3	1.6	2.9	3.5	2.1	9.4	1.8	14.8	30.2

POTTERY, TERRA COTTA, AND FIRE CLAY PRODUCTS.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	420	$10.32	$10.87	$5.69	$4.02	$250,177	24,242	$237,287	21,838	1.9	1.2	2.2	3.2	4.6	8.5	10.5	21.4	17.2
2	North Atlantic division	156	10.59	11.16	5.46	4.20	115,709	10,922	110,514	9,904	1.4	0.8	2.2	3.7	4.7	8.2	11.9	19.1	17.0
3	Massachusetts	22	10.03	10.72	5.66	2.94	6,878	686	6,435	600	0.2	0.3	2.8	1.0	3.8	5.8	17.8	19.2	15.2
4	Connecticut	3	8.21	9.51	4.28	......	961	117	837	88	......	......	......	1.1	11.4	10.2	29.6	15.9	13.6
5	New York	23	9.63	10.78	5.67	3.50	12,750	1,324	11,099	1,030	0.8	0.7	2.5	3.2	4.6	9.5	15.9	16.2	18.7
6	New Jersey	34	12.07	12.55	5.07	4.06	50,105	4,151	48,795	3,889	1.3	0.6	2.1	3.4	4.2	8.4	11.2	18.2	15.0
7	Pennsylvania	74	9.69	10.09	6.02	4.31	45,015	4,644	43,348	4,297	1.9	1.1	2.3	4.5	5.2	8.0	10.3	20.7	18.6

[1] Less than one-tenth of 1 per cent.
[2] Includes Arizona, 2; District of Columbia, 2; Montana, 2; Nevada, 1; Utah, 2.

RIES, AND GEOGRAPHIC DIVISIONS—PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND OF ALL WAGE-EARNERS AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

LUMBER, PLANING MILL PRODUCTS, INCLUDING SASH, DOORS, AND BLINDS—Continued.

MEN 16 YEARS AND OVER—continued. Per cent distribution of number by earnings—Continued.				WOMEN 16 YEARS AND OVER.													CHILDREN UNDER 16 YEARS.									
				Earnings.	Number.	Per cent distribution of number by earnings.											Earnings.	Number.	Per cent distribution of number by earnings.							
$12 to $15.	$15 to $20.	$20 to $25.	$25 and over			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
22.8	17.7	2.1	0.3	[illegible]	107	19.6	17.8	19.6	9.3	30.9	0.9	0.9	...	1.0	...	...	$735	173	8.1	27.2	34.1	26.0	4.6	...	...	21
22.3	17.9	1.9	0.1	138	41	31.7	29.3	29.3	4.9	2.4	2.4	...	...	...	...	...	160	35	8.6	11.4	...	80.0	...	...	...	22
29.5	16.1	2.0	0.3	[illegible]	2	100.0	...	...	...	...	...	...	...	...	...	...	8	[illegible]	...	50.0	...	50.0	...	...	...	23
27.0	31.8	3.3	0.4	28	4	...	25.0	...	25.0	...	...	25.0	...	25.0	...	...	90	20	...	20.0	55.0	15.0	10.0	...	...	24
14.8	7.4	0.5	(1)	112	27	22.2	14.8	26.0	18.5	18.5	...	...	...	...	...	...	185	42	...	19.1	71.4	9.5	...	...	...	25
26.7	12.6	1.2	0.7	14	[illegible]	...	50.0	50.0	...	...	...	...	...	...	...	...	92	21	...	28.6	47.6	14.3	9.5	...	...	26
21.1	11.7	2.3	0.2	163	27	...	...	...	3.7	96.3	...	...	...	...	...	...	[illegible]	16	...	68.8	31.2	...	...	...	...	27
20.4	11.5	1.5	0.4	6	1	...	...	...	...	100.0	...	...	...	...	...	...	64	20	55.0	25.0	5.0	10.0	5.0	...	...	28
26.8	19.8	4.4	1.0	...	...	...	...	...	...	...	...	...	...	...	...	...	58	14	...	57.1	14.3	14.3	14.3	...	...	29
54.2	33.3	8.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	30
25.3	39.5	3.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	16	3	...	...	...	66.7	33.3	...	...	31
18.8	29.2	3.2	...	5	1	...	...	...	100.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	32
13.4	12.4	1.7	0.3	7	2	50.0	...	50.0	...	...	...	...	...	...	...	...	189	54	13.0	44.4	40.7	...	...	1.9	...	33
20.5	6.7	0.2	0.1	...	...	...	...	...	...	...	...	...	...	...	...	...	60	16	6.2	12.5	81.3	...	...	...	...	34
9.6	11.6	3.8	0.1	...	...	...	...	...	...	...	...	...	...	...	...	...	53	16	6.2	62.5	31.3	...	...	...	...	35
7.7	4.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	24	8	50.0	50.0	...	...	...	...	...	36
9.1	13.2	0.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	37
26.4	21.7	0.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	38
6.5	8.3	2.3	0.7	...	...	...	...	...	...	...	...	...	...	...	...	...	9	2	...	...	100.0	...	...	...	...	39
25.0	50.0	8.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	40
18.4	65.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	41
14.1	31.3	3.1	0.4	7	2	50.0	...	50.0	...	...	...	...	...	...	...	...	43	12	8.3	66.7	16.7	...	...	8.3	...	42
25.1	24.2	17.3	2.9	36	[illegible]	...	...	...	...	100.0	...	...	...	...	...	...	257	61	1.6	42.6	45.9	1.6	1.7	3.3	3.3	43
43.5	39.1	13.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6	1	...	...	...	...	100.0	...	...	44
30.0	20.0	40.0	10.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45
20.0	36.3	22.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	46
17.7	23.5	38.2	5.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	47
36.9	23.2	4.4	0.8	...	...	...	...	...	...	...	...	...	...	...	...	...	3	1	100.0	...	...	...	...	...	...	48
25.5	26.4	12.8	3.4	[illegible]	1	...	...	...	...	100.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	49
20.2	23.6	23.2	3.7	[illegible]	5	...	...	...	...	100.0	...	...	...	...	...	...	248	59	...	44.1	47.4	1.7	...	3.4	3.4	50
29.7	26.9	8.5	0.5	...	...	...	...	...	...	...	...	...	...	...	...	...	13	[illegible]	...	66.7	...	...	...	33.3	...	51

PAPER AND WOOD PULP.

15.5	9.8	2.5	0.8	$37,329	6,277	2.5	5.4	17.9	17.4	38.0	11.3	4.6	2.0	0.4	0.3	0.2	$884	182	11.5	12.6	28.0	17.0	26.4	1.7	2.8	1
16.0	10.1	2.6	0.8	30,030	5,049	2.2	4.3	16.2	16.8	41.0	11.2	5.1	2.3	0.4	0.3	0.2	636	130	7.7	14.6	33.8	10.8	29.2	0.8	3.1	2
24.0	12.8	3.5	0.8	440	72	...	...	...	18.0	73.6	4.2	4.2	...	...	...	...	10	2	...	...	...	100.0	...	...	...	3
14.6	6.7	5.6	...	35	6	...	...	...	50.0	50.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
16.9	7.8	2.6	0.6	263	45	...	8.9	2.2	20.0	64.5	2.2	2.2	...	...	...	...	56	7	...	...	...	28.6	...	14.3	57.1	5
15.4	12.9	2.7	0.7	24,642	4,022	2.0	3.0	12.0	16.3	44.8	12.7	5.5	2.7	0.5	0.3	0.2	406	79	5.0	11.4	26.6	11.4	45.6	...	...	6
19.4	11.4	3.4	0.7	1,008	186	3.2	4.8	22.6	26.9	28.5	11.3	1.1	1.6	...	...	...	20	4	...	25.0	...	25.0	50.0	...	...	7
14.3	7.8	2.6	0.9	1,238	242	6.2	4.6	41.3	20.3	22.7	2.9	0.4	0.4	0.4	0.8	...	63	19	21.0	47.4	31.6	...	...	...	...	8
12.7	10.2	2.2	0.5	224	43	...	14.0	27.9	39.5	16.3	...	...	2.3	...	...	...	...	...	...	...	...	...	...	...	...	9
13.6	6.7	1.2	0.6	2,180	433	3.0	15.5	42.7	11.6	15.3	4.6	6.9	0.2	...	0.2	...	81	19	10.5	...	89.5	...	...	...	...	10
17.8	6.8	1.4	0.5	472	95	6.3	3.2	43.2	14.7	32.6	...	...	...	...	...	...	4	1	...	...	100.0	...	...	...	...	11
13.6	12.2	2.6	1.0	463	93	6.5	3.2	41.9	15.1	33.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	12
22.8	0.4	...	...	[illegible]	2	...	...	100.0	...	...	...	...	...	...	...	...	[illegible]	1	...	...	100.0	...	...	...	...	13
12.4	8.4	2.0	0.4	6,394	1,149	2.7	9.1	23.9	21.1	25.2	12.4	3.4	1.1	0.4	0.4	0.3	104	23	26.1	13.0	21.8	17.4	17.4	4.3	...	14
14.3	8.2	2.0	0.5	2,762	505	0.6	5.7	28.7	29.9	22.2	8.1	4.0	0.4	0.4	...	...	...	...	...	...	...	...	...	...	...	15
9.9	11.2	1.8	0.2	488	105	4.8	27.6	29.5	20.9	14.3	2.9	...	...	...	...	...	26	8	75.0	...	...	25.0	...	...	...	16
13.0	8.0	3.2	0.4	77	14	...	14.3	28.6	...	50.0	7.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	17
13.3	8.1	1.9	0.4	1,712	275	1.8	9.5	10.2	12.0	34.5	24.4	2.5	1.5	0.7	1.8	1.1	34	7	...	28.6	28.6	...	42.8	...	...	18
9.5	6.7	1.6	0.3	1,355	250	7.2	7.6	26.4	14.4	24.0	12.4	4.8	2.8	0.4	...	...	44	8	...	12.5	37.5	25.0	12.5	12.5	...	19
24.2	22.3	8.0	4.5	82	12	...	...	...	...	41.7	50.0	...	8.3	...	...	...	...	...	...	...	...	...	...	...	...	20
24.2	22.3	8.0	4.5	82	12	...	...	...	...	41.7	50.0	...	8.3	...	...	...	...	...	...	...	...	...	...	...	...	21
17.5	9.3	2.2	1.4	351	72	16.7	22.2	5.6	5.5	43.1	5.5	...	1.4	...	...	...	140	28	17.9	3.5	3.6	46.4	21.4	3.6	3.6	22

POTTERY, TERRA COTTA, AND FIRE CLAY PRODUCTS.

13.6	9.7	3.5	2.5	$10,975	1,928	5.6	15.7	23.3	20.9	11.4	9.8	4.0	2.6	2.3	3.6	0.8	$1,915	476	15.5	27.3	23.7	20.6	11.6	1.1	0.2	1
13.5	9.9	4.5	3.1	3,982	729	5.8	14.7	29.2	18.0	13.0	10.0	4.4	2.5	0.9	1.4	0.1	1,213	289	8.3	28.0	26.3	24.2	11.1	1.7	0.4	2
16.8	12.9	2.7	1.5	396	70	...	27.1	20.0	15.7	17.1	8.6	5.7	...	2.9	2.9	...	47	16	...	31.3	31.2	18.8	18.7	...	...	3
11.4	6.8	...	...	124	29	...	44.8	44.8	10.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
13.6	8.3	3.1	2.9	1,623	286	5.6	9.1	29.7	20.6	13.3	10.9	8.0	1.4	0.7	0.7	...	28	8	...	87.5	...	...	12.5	...	...	5
8.8	12.2	8.4	6.2	1,237	244	10.7	13.1	30.7	16.4	13.9	11.1	1.2	2.1	0.4	...	0.4	73	18	16.7	27.8	22.2	11.1	22.2	...	...	6
17.3	7.9	1.6	0.6	602	100	...	17.0	26.0	18.0	11.0	9.0	2.0	9.0	2.0	6.0	...	1,065	247	8.5	25.9	27.2	26.3	9.7	2.0	0.4	7

[3] Includes District of Columbia, 1; Georgia, 1; Iowa, 1; Kansas, 1; Minnesota, 2; Missouri, 1; Oregon, 2; South Carolina, 1; Washington, 1; West Virginia, 2.

TABLE 71.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE SELECTED INDUSTRIES, BY STATES, TERRITO- CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND AVERAGE WEEKLY EARNINGS, AND NUMBER

POTTERY, TERRA COTTA, AND FIRE CLAY PRODUCTS—Continued.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS: All wage-earners.	AVERAGE WEEKLY EARNINGS: Men 16 years and over.	AVERAGE WEEKLY EARNINGS: Women 16 years and over.	AVERAGE WEEKLY EARNINGS: Children under 16 years.	TOTAL: Earnings.	TOTAL: Number.	MEN 16 YEARS AND OVER: Earnings.	MEN 16 YEARS AND OVER: Number.	Per cent distribution of number by earnings: Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
8	South Atlantic division	45	$9.20	$9.93	$7.26	$3.30	$18,646	2,027	$16,363	1,648	3.3	2.6	3.0	5.4	6.1	13.5	15.2	14.1	9.7
9	Maryland	14	8.89	9.88	6.30	3.32	9,408	1,058	8,377	848	1.2	1.5	2.8	5.6	4.0	17.6	17.8	12.7	10.7
10	District of Columbia	4	8.03	8.03			899	112	899	112	8.9	4.5	8.0	4.5	11.6	14.3	18.8	9.8	7.1
11	West Virginia	10	11.05	12.08	7.97	6.00	7,081	641	5,845	484		0.2	0.2	2.9	5.2	5.2	10.9	22.1	10.9
12	North Carolina	4	4.56	5.14		0.50	73	16	72	14		21.4	14.3	21.4	28.6	7.1	7.2		
13	South Carolina	4	4.31	4.62		1.50	422	98	407	88	28.4	15.9	6.8	14.8	14.8	1.1	10.2	3.4	2.3
14	Georgia	9	7.48	7.48			763	102	763	102	9.8	5.9	7.8	5.9	10.8	29.4	15.7	2.9	5.9
15	North Central division	134	10.16	10.72	5.48	4.66	91,568	9,013	86,354	8,055	2.3	1.4	1.7	2.2	3.1	6.9	8.7	28.1	20.4
16	Ohio	70	9.82	10.39	6.08	3.00	49,120	5,000	45,142	4,343	3.3	1.5	1.7	2.2	3.2	7.8	11.9	30.8	13.7
17	Indiana	27	10.42	11.66	3.87	4.81	17,074	1,639	16,040	1,376	1.0	1.7	2.4	3.3	3.8	3.3	5.6	25.6	22.7
18	Illinois	20	10.79	10.86	5.72		14,804	1,372	14,701	1,354	1.7	1.5	1.7	1.9	3.8	6.3	5.4	19.1	31.7
19	Michigan	3	10.13	10.13			790	78	790	78								67.9	15.4
20	Missouri	14	10.58	10.71		4.95	9,780	924	9,681	904	0.4	0.4	0.7	1.0	1.4	9.7	3.9	29.0	32.1
21	South Central division	39	8.69	8.82		4.38	7,335	844	7,230	820	1.3	2.2	4.9	5.7	12.7	23.4	11.5	12.0	11.7
22	Kentucky	13	8.27	8.40		4.50	5,069	613	4,979	593	1.2	1.9	5.1	7.1	13.0	26.8	10.1	11.6	15.0
23	Tennessee	3	10.61	10.70		3.00	902	85	899	84	2.4	4.8	2.4		2.4	1.1	36.9	11.9	1.2
24	Alabama	[illegible]	5.50	5.50			55	10	55	10			60.0	30.0					
25	Texas	17	9.62	9.75		4.00	1,309	136	1,297	133	1.5	2.2	1.5	1.5	18.8	24.1	2.2	14.3	4.5
26	Western division	27	12.97	13.03	6.00	3.33	9,456	729	9,434	724	1.0	0.3	1.8	1.0	1.1	2.3	1.9	3.2	12.1
27	Colorado	7	12.40	12.45	6.00		3,547	286	3,535	284	0.3			0.7	1.8	4.6	2.1		25.0
28	Utah	4	12.96	13.50		1.00	298	23	297	22	9.1					4.5	9.1	9.1	4.6
29	Washington	4	13.69	13.69			2,313	169	2,313	169			5.3	0.6		0.6		4.1	1.2
30	California	12	13.14	13.21		4.50	3,298	251	3,289	249	1.6	0.8	1.6	1.6	1.2	0.8	2.4	5.6	5.6
31	All other states	[1] 19	10.56	10.76	3.37	7.00	7,463	707	7,392	687	4.1	1.0	1.7	4.4	9.3	7.0	8.0	25.2	12.7

PRINTING AND PUBLISHING, BOOK AND JOB.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS: All wage-earners.	AVERAGE WEEKLY EARNINGS: Men 16 years and over.	AVERAGE WEEKLY EARNINGS: Women 16 years and over.	AVERAGE WEEKLY EARNINGS: Children under 16 years.	TOTAL: Earnings.	TOTAL: Number.	MEN 16 YEARS AND OVER: Earnings.	MEN 16 YEARS AND OVER: Number.	Per cent distribution of number by earnings: Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	4,802	$11.21	$12.94	$6.54	$3.54	$593,204	52,916	$509,174	39,345	2.3	3.7	4.5	4.2	5.0	5.0	4.9	6.1	9.5
2	North Atlantic division	2,179	11.40	12.90	7.16	3.62	275,337	24,160	234,315	18,157	2.9	3.8	4.6	4.4	5.0	4.4	4.7	5.6	9.3
3	Maine	52	9.35	10.89	6.30	3.00	2,759	295	2,177	200	2.0	8.0	4.0	2.5	7.0	4.5	4.0	6.0	16.5
4	New Hampshire	32	9.86	10.45	8.32		1,656	168	1,265	121	1.6	5.0	6.6	3.3	8.3	4.1	1.6	5.0	14.0
5	Vermont	26	9.10	10.27	5.42		719	79	616	60		3.3	1.7	3.3	16.7	5.0		10.0	31.6
6	Massachusetts	428	11.22	12.86	7.85	3.61	66,920	5,964	52,766	4,103	1.2	3.1	4.1	3.4	4.6	3.5	4.4	4.9	8.2
7	Rhode Island	59	10.18	12.46	5.70	3.05	5,660	556	4,696	377	0.8	3.7	3.4	6.9	4.5	3.4	4.5	2.4	13.3
8	Connecticut	99	10.56	11.95	6.28	3.50	4,877	462	4,232	354	1.4	4.0	4.5	5.7	4.8	3.1	4.2	6.5	9.6
9	New York	865	12.14	13.38	7.30	3.78	138,833	11,433	123,012	9,196	4.3	3.8	4.7	4.5	4.7	4.6	5.1	6.1	8.5
10	New Jersey	146	10.80	12.84	6.80	3.82	14,262	1,321	11,571	901	1.6	3.8	4.1	3.5	8.2	6.1	4.9	4.1	9.8
11	Pennsylvania	472	10.21	11.94	5.94	3.52	39,651	3,882	33,980	2,845	1.7	4.5	5.1	5.2	5.2	5.2	4.3	5.9	11.7
12	South Atlantic division	362	9.15	10.61	5.20	2.93	29,895	3,266	26,042	2,454	3.7	6.8	5.3	5.6	7.0	7.7	6.8	6.8	9.9
13	Delaware	9	9.80	12.49	5.24	4.17	843	86	687	55	3.6	1.8	5.4	5.5	3.6	9.1		5.5	1.8
14	Maryland	107	9.19	10.48	5.40	2.75	12,184	1,326	10,803	1,031	4.2	8.2	5.4	5.0	7.4	7.2	7.2	6.4	8.6
15	District of Columbia	43	10.13	11.57	6.21	2.89	5,237	517	4,441	384	2.3	4.7	5.7	6.2	7.3	7.6	4.4	7.6	12.5
16	Virginia	54	8.25	10.20	4.36	2.88	3,514	426	2,938	288	2.4	8.3	5.9	5.2	10.8	5.9	7.6	5.6	7.3
17	West Virginia	26	9.84	12.22	5.46	4.33	1,731	176	1,417	116	0.8	3.4	2.6	5.2	2.6	19.0	0.9	4.3	8.6
18	North Carolina	38	8.20	9.41	3.40	2.33	1,246	152	1,157	123	4.9	8.1	4.9	4.9	6.5	13.0	9.0	8.1	12.2
19	South Carolina	20	6.93	7.74	4.50	2.00	617	89	565	73	11.0	11.0	8.2	4.1	12.3	2.7	9.6	16.4	9.6
20	Georgia	46	9.10	10.32	4.51	2.91	3,722	409	3,365	326	4.3	4.6	5.2	7.7	4.3	5.8	8.0	7.4	14.1
21	Florida	19	9.42	11.53	6.00	3.27	801	85	669	58		3.5		6.9	3.5	6.9	17.2	1.7	12.1
22	North Central division	1,573	11.02	13.00	6.07	3.46	211,839	19,228	181,081	13,924	1.6	3.4	4.4	4.1	4.7	5.2	5.0	6.7	9.8
23	Ohio	296	9.56	11.15	5.57	3.34	26,512	2,773	22,464	2,015	2.1	5.8	4.7	5.6	7.5	6.8	5.7	7.7	11.8
24	Indiana	109	10.09	11.91	5.16	3.06	13,440	1,332	11,703	983	1.3	4.9	5.4	5.7	5.5	5.5	6.4	7.9	8.6
25	Illinois	497	12.21	14.35	6.58	3.66	101,210	8,288	87,286	6,081	1.6	1.8	4.4	2.7	3.4	3.6	4.4	7.4	9.0
26	Michigan	132	9.12	11.31	4.62	3.17	12,387	1,358	10,387	918	2.2	5.5	4.8	6.0	5.7	7.3	7.4	7.4	10.5
27	Wisconsin	66	8.91	11.60	4.32	3.09	6,488	728	5,453	470	1.3	5.9	5.1	5.1	5.1	5.3	5.1	4.5	16.4
28	Minnesota	92	11.46	13.16	7.77	3.00	11,968	1,044	9,500	722	1.2	6.0	6.4	6.2	5.5	6.1	4.4	4.2	7.5
29	Iowa	75	9.50	11.06	5.44	3.86	4,159	438	3,561	322	1.5	5.0	5.0	7.8	7.1	7.1	3.1	5.6	11.2
30	Missouri	207	11.00	12.94	6.18	3.58	28,245	2,568	24,228	1,872	1.1	2.3	2.2	2.9	4.2	6.4	4.9	4.3	9.4
31	North Dakota	6	12.15	13.45	7.83		316	26	269	20				10.0	5.0	10.0			10.0
32	South Dakota	3	11.24	11.47	9.50		191	17	172	15		6.7	13.3			6.7			33.4
33	Nebraska	43	11.09	12.65	5.98	3.44	4,624	417	4,085	323	0.6	2.5	4.6	5.6	5.6	7.1	4.9	5.3	9.0
34	Kansas	47	9.62	10.78	6.40	2.38	2,299	239	1,973	183	1.1	3.3	7.1	3.8	3.8	6.0	7.1	11.5	9.8
35	South Central division	290	10.51	12.52	5.13	3.16	32,954	3,136	29,171	2,330	3.3	3.5	4.9	4.5	5.7	6.5	4.8	7.5	10.8
36	Kentucky	59	9.35	11.20	5.41	2.82	8,452	904	7,143	638	5.7	6.1	6.6	5.2	8.6	8.3	6.4	3.9	11.4
37	Tennessee	43	10.61	13.36	4.70	3.32	7,154	674	6,237	467	1.3	1.5	2.6	3.0	4.5	4.9	3.4	8.6	11.3
38	Alabama	30	10.90	12.67	6.08	4.11	1,918	176	1,698	134	5.2	1.5	3.7	1.5	6.7	4.5	3.7	8.2	17.2
39	Mississippi	13	10.00	11.44	8.17	3.67	460	46	389	34			5.9	2.9	5.9	5.9	5.9		8.8
40	Louisiana	32	10.03	10.96	5.58	2.41	2,257	225	2,149	196	2.0	2.6	4.1	1.5	7.7	4.6	8.2	24.5	11.2
41	Arkansas	11	11.41	13.57	6.20	4.50	1,073	94	909	67		3.0	1.5	1.5	3.0	8.9	1.5	8.9	6.0
42	Indian Territory	4	12.00	13.00		7.00	72	6	65	5								20.0	
43	Oklahoma	12	10.64	11.87	6.80	3.20	596	56	546	46				4.4	4.4	4.3	6.5	13.0	8.7
44	Texas	86	11.49	13.51	4.71	3.08	10,972	955	10,035	743	3.1	3.5	5.9	6.5	3.8	6.9	3.9	5.1	9.3

[1] Includes Arkansas, 1; Iowa, 2; Kansas, 2; Louisiana, 2; Maine, 2; Minnesota, 1; Mississippi, 1; Montana, 1; New Hampshire, 1; Oregon, 2; Virginia, 2; Wisconsin, 2.

RIES, AND GEOGRAPHIC DIVISIONS—PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND OF ALL WAGE-EARNERS AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

POTTERY, TERRA COTTA, AND FIRE CLAY PRODUCTS—Continued.

MEN 16 YEARS AND OVER—continued.				WOMEN 16 YEARS AND OVER.													CHILDREN UNDER 16 YEARS.									
Per cent distribution of number by earnings—Continued.				Earnings.	Number.	Per cent distribution of number by earnings.											Earnings.	Number.	Per cent distribution of number by earnings.							
$12 to $15.	$15 to $20.	$20 to $25.	$25 and over			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
12.1	8.7	3.4	2.9	$1,894	261	3.1	6.1	8.4	13.4	23.7	14.9	6.9	5.4	7.7	7.3	3.1	$389	118	38.1	32.2	13.6	6.8	9.3			8
14.3	7.2	2.8	1.8	706	112	7.1	14.3	16.1	10.7	23.2	8.9	7.1	4.5	2.7	2.7	2.7	325	98	33.7	38.8	16.3	8.2	3.0			9
8.0	2.7		1.8																							10
14.1	16.1	6.2	6.0	1,188	149			2.7	15.4	24.2	19.5	6.7	6.0	11.4	10.7	3.4	48	8					100.0			11
1.1	1.2																1	2	100.0							12
1.0	1.0	2.0	1.9														15	10	100.0							13
																										14
11.9	9.1	2.3	1.9	5,023	917	4.6	19.6	23.2	25.7	6.4	8.4	2.9	2.1	1.9	4.5	0.7	191	41	9.8	12.2	24.4	29.2	24.4			15
11.6	8.6	2.0	1.7	3,963	652	3.8	13.2	15.7	32.5	6.5	11.5	4.1	2.9	2.6	6.3	0.9	15	5	40.0	40.0	20.0					16
10.6	12.9	3.2	3.9	957	247	6.9	38.1	44.9	6.9	2.8	0.4						77	16	12.5		6.3	56.2	25.0			17
13.7	7.3	3.8	2.1	103	18				38.9	55.6	5.5															18
14.1	2.6																									19
12.1	8.8	0.5															99	20		15.0	40.0	15.0	30.0			20
6.0	7.4	1.0	0.2														105	24		20.8	45.8	33.4				21
3.7	3.2	1.0	0.3														90	20		20.0	40.0	40.0				22
11.9	25.0																3	1		100.0						23
10.0																										24
12.1	15.8	1.5															12	3			100.0					25
46.8	21.3	5.1	2.1	12	2					100.0							10	3	33.3	33.4			33.3			26
40.8	19.7	3.2	1.8	12	2					100.0																27
22.7	18.2	22.7															1	1	100.0							28
47.4	33.7	6.5	0.6																							29
55.5	14.9	4.8	3.6														9	2		50.0			50.0			30
11.9	8.0	4.7	2.0	64	19	84.2		5.3		10.5							7	1					100.0			31

PRINTING AND PUBLISHING, BOOK AND JOB.

$12 to $15.	$15 to $20.	$20 to $25.	$25 and over	Women: Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over	Children: Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
15.3	25.1	9.7	4.7	$78.433	11,988	7.2	10.9	13.4	15.1	15.4	12.6	8.3	4.6	5.9	3.8	2.8	$5,597	1,583	24.0	41.8	20.7	8.0	3.0	1.4	1.1	1
17.3	24.0	9.1	4.9	39,037	5,454	7.3	8.2	10.6	14.4	14.5	12.9	9.4	5.5	8.5	4.7	4.0	1,985	549	18.0	43.9	24.2	9.9	2.9	0.7	0.4	2
21.0	20.0	3.5	1.0	567	90	2.2	3.3	14.5	20.0	15.6	23.3	11.1	6.7	3.3			15	5	40.0	40.0	20.0					3
31.4	17.4	1.7		391	47		2.1	6.4	10.6	10.6	14.9	10.6	23.4	12.8	4.3	4.3										4
16.7	6.7	5.0		103	19	5.3	21.0	10.5	10.5	26.3	5.3	5.3	15.8													5
21.1	31.7	6.6	3.2	13,761	1,752	3.7	7.4	6.7	12.5	12.7	15.4	10.6	6.3	12.5	7.8	4.4	393	109	18.3	41.3	26.6	9.2	3.7	0.9		6
17.0	35.5	2.7	1.9	900	133	1.9	3.2	21.5	23.4	36.1	1.9	5.7	2.5	1.9	1.9		64	21	28.6	47.6	23.8					7
20.1	30.8	4.2	1.1	603	96	7.3	7.3	6.3	22.9	19.8	14.6	6.2	10.4	4.2		1.0	42	12	8.3	66.7	25.0					8
15.1	20.1	11.1	7.4	15,276	2,093	12.0	9.3	10.8	13.6	12.9	10.0	7.2	5.5	8.5	4.5	5.7	545	144	19.4	35.4	25.0	13.2	4.9	1.4	0.7	9
15.8	19.6	15.8	2.7	2,477	364	9.6	3.6	10.4	21.4	14.6	11.5	9.3	4.7	8.8	1.4	4.7	214	56	12.5	39.3	23.2	21.4	3.6			10
17.8	25.4	6.5	1.5	4,959	835	4.3	11.0	16.9	14.4	17.6	16.2	13.3	2.6	1.8	1.5	0.4	712	202	17.3	51.0	22.8	6.4	1.5	0.5	0.5	11
13.9	20.7	4.4	1.4	3,376	649	13.2	19.3	16.5	15.1	15.6	8.6	5.5	1.4	2.8	1.5	0.5	477	163	50.9	33.1	9.2	3.7	0.6	1.9	0.6	12
29.1	27.3	5.5	1.8	131	25	8.0	16.0	20.0	12.0	16.0	16.0	8.0		4.0			25	6	16.7	16.7	66.6					13
13.1	21.5	4.2	1.6	1,161	215	14.9	14.0	16.7	20.5	8.8	12.1	6.0	0.9	3.3	1.4	1.4	220	80	62.5	28.8	7.5			1.2		14
12.8	19.0	7.8	2.1	770	124	9.7	7.3	14.5	7.3	29.0	10.5	7.3	4.0	6.4	4.0		26	9	11.1	88.9						15
13.5	24.0	2.1	1.4	527	121	14.9	33.9	20.6	14.9	6.6	6.6	2.5					49	17	58.8	11.8	17.6	11.8				16
12.1	31.9	6.0	2.6	262	48	2.1	18.8	10.4	22.9	31.2	6.2	2.1		4.2	2.1		52	12	25.0	33.4		8.3	8.3	16.7	8.3	17
8.1	18.7	1.6		68	20	10.0	70.0	10.0	5.0	5.0							21	9	55.6	33.3	11.1					18
5.5	9.6			36	8		25.0	25.0	50.0								16	8	62.5	25.0	12.5					19
19.0	14.4	4.9	0.3	325	72	26.4	19.4	16.7	6.9	18.0	2.8	5.6	2.8		1.4		32	11	36.4	63.6						20
19.0	24.1	3.4	1.7	96	16		12.5	12.5	18.8	31.2		25.0					36	11	26.3	36.4		27.3				21
13.8	27.8	9.4	4.1	28,837	4,748	6.7	12.0	15.8	15.6	16.5	13.8	7.6	3.6	3.4	3.4	1.6	1,921	556	19.1	50.5	21.6	6.3	1.8	0.4	0.3	22
11.3	24.3	5.4	1.3	3,784	679	5.7	14.9	18.9	19.9	18.4	13.8	3.7	2.2	0.7	0.6	1.2	264	79	11.4	70.9	11.4	6.3				23
13.0	28.4	5.9	1.5	1,642	318	6.0	20.1	19.8	18.6	16.4	9.1	4.1	1.6	3.1	0.6	0.6	95	31	35.5	41.9	16.1	6.5				24
12.7	29.5	13.5	6.0	13,185	2,005	5.4	9.9	13.1	14.5	13.9	14.5	10.6	5.4	4.6	6.1	2.0	739	202	16.3	41.6	32.7	7.4	2.0			25
11.5	24.5	4.0	3.2	1,924	416	16.6	17.3	29.6	11.8	13.2	5.3	3.8	1.4	0.5	0.5		76	24	25.0	66.7	4.2			4.1		26
13.4	24.7	6.4	1.7	834	193	28.0	16.6	26.4	12.4	8.8	2.6	1.6	0.5	2.1	0.5	0.5	201	65	44.6	44.6	7.7		1.6		1.5	27
12.7	24.5	8.2	7.1	2,447	315	4.1	6.7	7.3	14.6	12.4	13.7	16.5	6.0	9.2	4.4	5.1	21	7	14.3	85.7						28
16.2	25.5	4.3	0.6	517	95	6.3	12.6	16.8	23.2	22.1	10.5	2.1		3.2	3.2		81	21	33.3	33.3	9.5	9.5	4.8	4.8	4.8	29
20.6	30.6	7.7	3.4	3,623	586	1.4	8.5	10.4	15.5	29.2	23.7	5.0	2.1	1.7	1.0	1.5	394	110	2.7	60.0	25.5	8.2	3.6			30
15.0	35.0	15.0		47	6				16.7	33.3		16.7		16.7	16.6											31
13.3	13.3	13.3		19	2								50.0	50.0												32
16.7	26.0	9.6	2.5	508	85	2.4	18.8	17.6	11.8	15.3	17.6	4.7	4.7	3.5	2.4	1.2	31	9	22.2	22.2	44.5	11.1				33
15.9	27.3	3.3		307	48	4.1	2.1	16.7	22.9	22.9	10.4	6.2	4.2	4.2	4.2	2.1	19	8	62.5	25.0		12.5				34
12.7	20.8	10.6	4.4	3,220	628	8.0	24.1	19.3	13.9	15.6	8.4	3.8	3.3	1.9	1.1	0.6	563	178	45.5	30.3	10.7	7.3	4.5	1.1	0.6	35
9.9	14.7	9.1	4.1	1,168	216	13.0	22.2	18.0	10.2	10.6	7.9	6.9	5.6	4.2	1.4		141	50	70.0	14.0	8.0	8.0				36
18.0	31.5	5.6	3.8	781	166	0.6	32.5	18.7	16.9	14.4	14.5	2.4					136	41	12.2	70.7	7.3	2.5	7.3			37
12.0	22.4	9.7	3.7	146	24		29.2	16.7	16.7	16.7		12.5		4.1		4.1	74	18	27.8	16.6	22.2	22.2	5.6		5.6	38
38.3	23.5	2.9		49	6				16.7	16.7	16.7		33.3		16.6		22	6	66.7				16.7	16.6		39
13.2	15.8	2.0	2.6	67	12	16.7	16.7	25.0	8.3	16.7		8.3				8.3	41	17	70.6	23.5	5.9					40
25.4	20.9	16.4	3.0	155	25	8.0	4.0	20.0	24.0	4.0	16.0		8.0	4.0	8.0	4.0	9	2		50.0		50.0				41
40.0	40.0																7	1						100.0		42
28.3	23.9	6.5		34	5			40.0	20.0				20.0		20.0		16	5	20.0	60.0	20.0					43
8.3	19.9	17.6	6.2	820	174	9.8	22.4	21.2	13.8	24.7	4.0	0.6	2.3	0.6		0.6	117	38	50.0	18.4	15.8	7.9	7.9			44

TABLE 71.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE SELECTED INDUSTRIES, BY STATES, TERRITO- CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND AVERAGE WEEKLY EARNINGS, AND NUMBER

PRINTING AND PUBLISHING, BOOK AND JOB—Continued.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
45	Western division	395	$13.81	$15.55	$7.79	$4.75	$43,014	3,115	$38,400	2,469	0.2	2.1	3.0	2.5	3.5	2.9	3.5	4.7	7.9
46	Montana	6	18.02	20.42	11.00	7.00	937	52	817	40	......	......	2.5	2.5	......	......	2.5	......	15.0
47	Idaho	5	16.33	18.40	6.00	......	196	12	184	10	......	......	......	......	......	10.0	......	......	10.0
48	Wyoming	3	13.62	16.55	7.20	......	218	16	182	11	9.1	......	......	......	......	......	......	18.2	......
49	Colorado	57	13.69	15.59	7.28	5.03	7,640	558	6,874	441	0.4	3.9	2.5	2.3	2.7	2.9	4.3	4.8	4.5
50	Utah	17	11.71	14.07	5.61	3.50	1,276	109	1,140	81	1.2	3.7	2.5	......	1.2	3.7	3.7	11.1	12.4
51	Washington	58	14.79	15.65	7.75	4.50	5,456	369	5,181	331	0.3	0.3	5.1	3.3	2.7	2.1	4.2	3.3	13.9
52	Oregon	32	14.54	15.36	7.55	......	3,038	209	2,872	187	......	3.2	2.2	4.3	6.4	2.7	2.1	7.5	4.8
53	California	217	13.55	15.46	7.97	4.71	24,253	1,790	21,150	1,368	0.1	1.8	2.8	2.3	3.9	3.1	3.4	4.3	7.6
54	All other states	[1] 3	15.00	15.00	......	......	165	11	165	11	......	......	......	......	......	......	......	18.2	9.1

PRINTING AND PUBLISHING, NEWSPAPERS AND PERIODICALS.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	10,860	$11.39	$13.13	$5.95	$2.87	$735,079	64,551	$652,017	49,642	3.4	3.5	3.8	4.3	6.1	4.9	4.8	6.8	12.0
2	North Atlantic division	1,982	12.89	14.86	6.82	3.05	295,095	22,891	259,748	17,485	2.8	3.1	3.5	3.7	4.6	3.7	3.9	5.5	10.0
3	Maine	65	8.04	11.22	5.84	4.22	6,718	836	3,860	344	1.4	3.2	4.1	7.0	10.2	6.4	6.1	7.8	9.9
4	New Hampshire	36	9.60	11.48	6.36	2.33	2,132	222	1,642	143	0.7	6.3	2.8	1.4	3.5	2.1	4.9	10.5	18.9
5	Vermont	46	9.08	10.30	6.86	3.75	3,587	395	2,667	259	5.8	2.7	3.4	5.0	8.1	2.7	5.4	10.4	11.6
6	Massachusetts	239	14.29	16.17	7.86	3.25	75,412	5,279	66,549	4,116	1.3	2.2	3.6	3.2	3.5	2.6	2.3	3.2	7.6
7	Rhode Island	26	13.59	15.08	6.86	4.43	5,014	369	4,616	306	3.6	0.7	2.6	3.9	5.2	3.6	4.6	2.9	11.4
8	Connecticut	50	14.22	15.16	9.08	3.30	5,829	410	5,337	352	0.6	2.6	2.6	2.8	6.0	4.5	3.1	3.4	8.2
9	New York	666	14.35	16.22	7.25	3.12	122,676	8,550	110,297	6,801	2.8	2.6	2.9	3.4	4.2	3.8	3.7	6.1	10.2
10	New Jersey	197	11.48	12.36	6.19	2.87	15,881	1,383	14,966	1,211	6.7	5.0	4.0	4.9	4.8	3.1	4.6	6.3	10.6
11	Pennsylvania	657	10.62	12.60	5.75	2.84	57,846	5,447	49,814	3,953	3.0	4.4	4.3	4.1	5.6	4.6	5.5	6.4	11.7
12	South Atlantic division	862	9.16	10.33	4.65	2.46	40,238	4,394	37,076	3,589	6.0	6.2	6.8	7.4	10.9	7.8	5.9	7.7	9.8
13	Delaware	25	7.41	8.01	5.04	2.25	1,238	167	1,098	137	15.4	16.1	12.4	3.6	4.4	1.5	3.6	2.9	7.3
14	Maryland	95	10.72	11.93	4.15	2.13	7,770	725	7,395	620	4.4	6.9	5.2	6.8	9.2	7.3	6.4	6.6	9.8
15	District of Columbia	20	14.65	16.85	5.00	3.14	6,401	437	6,014	357	2.2	2.0	3.6	4.8	5.0	3.4	3.1	4.5	8.7
16	Virginia	110	8.51	9.25	4.39	2.80	3,666	431	3,451	373	3.8	8.1	5.9	8.6	13.9	8.8	5.9	8.0	11.5
17	West Virginia	133	8.40	10.43	4.72	2.42	4,529	539	3,756	360	1.7	2.8	5.0	4.7	7.8	6.4	8.3	10.6	11.9
18	North Carolina	137	6.89	7.79	3.91	2.49	4,169	605	3,816	490	10.2	6.1	8.6	9.6	13.7	11.6	7.5	8.2	9.4
19	South Carolina	98	7.43	8.09	4.85	2.33	3,174	427	2,944	364	10.2	10.4	9.9	8.0	15.7	7.7	4.7	9.3	6.8
20	Georgia	168	8.84	9.70	4.20	2.43	6,627	750	6,306	650	6.5	4.9	7.6	8.9	13.9	9.2	6.0	7.8	8.6
21	Florida	76	8.51	9.65	5.44	2.57	2,664	313	2,296	238	4.6	5.0	7.1	7.6	6.3	8.4	4.2	8.8	16.0
22	North Central division	5,321	9.90	11.67	5.21	2.73	256,702	25,942	222,528	19,065	3.9	3.7	3.9	4.6	6.7	5.5	5.6	8.3	14.6
23	Ohio	556	10.91	12.77	5.14	2.52	47,510	4,355	42,298	3,311	3.3	3.7	4.3	3.8	6.3	4.9	5.1	6.8	11.7
24	Indiana	429	9.08	11.08	4.69	2.43	22,822	2,514	19,382	1,749	4.4	3.4	3.5	3.9	8.2	6.0	6.2	9.7	12.9
25	Illinois	767	11.74	13.37	5.63	2.85	50,783	4,326	46,046	3,444	3.4	3.7	3.0	3.7	4.6	3.8	4.6	6.7	13.8
26	Michigan	415	9.54	11.29	5.00	2.57	22,089	2,316	19,105	1,692	4.5	4.1	4.1	5.4	5.1	5.3	5.1	10.0	14.1
27	Wisconsin	365	7.79	9.16	4.92	2.38	9,760	1,253	7,947	868	5.0	5.0	6.7	5.6	7.5	8.4	5.5	10.5	17.2
28	Minnesota	446	11.46	12.63	6.60	3.08	25,321	2,210	22,768	1,802	2.8	3.5	3.4	5.0	4.8	5.0	6.0	6.3	14.7
29	Iowa	678	8.24	9.86	5.12	2.78	21,980	2,666	17,838	1,810	4.0	3.7	4.0	5.0	9.2	6.9	7.3	10.0	17.7
30	Missouri	552	9.37	11.21	4.52	2.63	24,100	2,573	21,225	1,894	6.6	4.6	5.0	5.9	8.6	6.9	6.9	8.9	13.3
31	North Dakota	151	11.74	12.99	7.57	3.29	4,263	363	3,806	293	0.3	2.1	2.7	3.4	3.1	2.1	2.7	2.4	10.9
32	South Dakota	176	9.66	11.09	6.86	3.38	4,048	419	3,194	288	1.0	1.0	0.7	4.9	4.5	3.5	3.1	8.0	26.4
33	Nebraska	326	8.52	10.28	5.60	3.21	9,060	1,064	6,991	680	3.4	1.5	5.0	5.6	6.3	6.5	6.5	10.3	19.2
34	Kansas	460	7.95	9.67	4.89	2.70	14,966	1,883	11,928	1,234	3.7	3.5	3.7	4.7	11.0	6.4	6.0	11.0	18.2
35	South Central division	1,579	9.72	10.71	4.92	2.81	53,186	5,574	48,880	4,564	3.2	3.6	4.1	5.7	9.7	7.4	7.0	9.3	16.2
36	Kentucky	193	10.09	11.28	3.95	2.45	10,292	1,020	9,766	866	6.3	5.1	5.3	4.9	9.5	8.4	10.0	8.8	11.2
37	Tennessee	149	9.06	10.01	4.92	2.68	5,609	619	5,165	516	3.7	6.2	4.3	7.7	16.7	5.6	5.6	5.0	11.4
38	Alabama	104	8.08	8.92	4.28	2.61	2,820	349	2,623	294	7.2	7.8	6.1	8.5	9.5	11.1	8.8	9.5	8.2
39	Mississippi	117	9.02	10.44	4.70	3.23	3,346	371	2,995	287	1.4	2.1	2.4	7.3	12.5	8.4	8.4	6.6	12.2
40	Louisiana	97	11.32	12.35	5.00	2.36	3,555	314	3,446	279	1.4	1.8	3.6	5.0	7.9	8.3	4.3	9.3	14.7
41	Arkansas	197	8.62	10.12	4.70	2.98	6,097	707	5,334	527	3.8	2.6	4.6	6.1	9.9	7.4	7.8	8.3	19.3
42	Indian Territory	108	9.29	10.46	5.30	3.27	2,888	311	2,574	246	1.2	1.6	1.2	3.3	7.3	5.3	4.1	13.0	23.2
43	Oklahoma	168	8.79	10.28	5.90	3.42	4,343	494	3,494	340	0.3	1.2	1.2	3.8	9.1	6.2	4.4	12.6	25.3
44	Texas	446	10.25	11.15	5.01	2.76	14,236	1,389	13,483	1,209	1.6	2.6	4.3	5.4	7.3	6.9	6.4	10.7	19.8
45	Western division [2]	1,116	15.63	16.96	8.39	3.80	89,858	5,750	83,785	4,939	1.7	2.3	1.6	2.3	2.7	2.1	1.8	2.9	6.4
46	Montana	63	22.00	23.19	11.77	5.00	8,712	396	8,317	359	......	0.8	0.3	1.7	0.6	1.4	0.8	2.2	3.6
47	Idaho	54	13.10	15.12	8.19	3.54	2,149	164	1,890	125	......	......	0.8	0.8	3.2	1.6	1.6	5.6	4.0
48	Wyoming	35	13.45	15.50	7.12	4.00	1,654	123	1,457	94	......	1.1	......	4.2	4.2	1.1	4.3	......	6.4
49	Colorado	179	14.69	15.62	7.96	4.15	12,747	868	12,059	772	5.2	2.1	1.8	2.6	3.0	3.2	2.2	3.4	6.9
50	New Mexico	37	11.89	12.32	8.33	4.17	1,689	142	1,639	133	......	2.3	2.3	4.5	8.3	6.0	1.5	7.5	9.0
51	Arizona	34	16.23	17.48	7.58	4.00	2,240	138	2,133	122	......	......	1.6	......	2.5	1.6	......	5.7	9.0
52	Utah	35	12.54	14.08	7.33	2.00	2,044	163	1,872	133	2.2	2.2	9.0	4.5	3.8	3.8	3.8	5.3	6.8
53	Nevada	25	18.75	20.10	8.00	4.67	1,481	79	1,427	71	1.4	1.4	......	......	1.4	2.8	2.8	2.8	5.6
54	Washington [2]	155	15.13	15.98	8.00	2.56	12,213	807	11,630	728	1.1	8.4	1.1	2.2	2.2	2.1	2.3	2.9	4.9
55	Oregon	96	15.45	17.53	7.05	4.45	7,738	501	7,083	404	0.7	1.2	2.0	4.0	1.7	1.5	2.0	5.7	5.4
56	California	403	15.70	17.16	8.88	3.84	37,191	2,369	34,278	1,998	1.4	1.2	1.5	1.9	2.8	1.6	1.4	1.6	7.3

[1] Includes Arizona, 2; Nevada, 1.

RIES, AND GEOGRAPHIC DIVISIONS—PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND OF ALL WAGE-EARNERS AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

PRINTING AND PUBLISHING, BOOK AND JOB—Continued.

MEN 16 YEARS AND OVER—continued. Per cent distribution of number by earnings—Continued. $12 to $15.	$15 to $20.	$20 to $25.	$25 and over	WOMEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over	CHILDREN UNDER 16 YEARS. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
14.0	25.9	20.4	9.4	$3,963	509	1.0	3.7	9.4	19.3	13.2	10.0	11.6	10.2	9.8	5.9	5.9	$651	137	8.0	22.6	29.2	13.9	9.5	8.0	8.8	45
10.0	10.0	12.5	45.0	99	9	....	....	....	....	....	11.1	....	....	66.7	11.1	11.1	21	3	....	....	....	....	....	100.0	....	46
10.0	....	60.0	10.0	12	2	....	....	....	....	100.0	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	47
9.1	9.1	54.5	....	36	5	....	20.0	20.0	40.0	....	....	....	....	....	....	20.0	....	....	....	....	....	....	....	....	....	48
14.5	18.8	26.8	11.6	575	79	3.8	....	2.5	26.6	8.9	5.1	24.0	16.4	8.9	2.5	1.3	191	38	5.3	21.0	31.6	7.9	10.5	10.5	13.2	49
17.3	16.1	22.2	4.9	101	18	....	27.8	11.1	11.1	16.7	11.1	16.7	5.5	....	....	....	35	10	20.0	50.0	20.0	10.0	....	....	....	50
9.5	29.6	16.0	9.7	248	32	....	....	6.3	15.6	12.5	18.7	21.9	9.4	9.4	3.1	3.1	27	6	....	50.0	16.7	16.7	....	....	16.6	51
13.4	23.5	18.7	11.2	166	22	....	....	....	....	40.9	13.6	9.1	27.3	9.1	....	....	....	....	....	....	....	....	....	....	....	52
14.9	28.9	19.2	7.7	2,726	342	0.6	3.8	12.0	19.9	12.3	10.2	8.2	8.5	9.3	7.6	7.6	377	80	8.8	18.8	31.2	17.5	11.2	5.0	7.5	53
27.2	18.2	18.2	9.1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	54

PRINTING AND PUBLISHING, NEWSPAPERS AND PERIODICALS.

$12 to $15.	$15 to $20.	$20 to $25.	$25 and over	Women: Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over	Children: Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
15.0	16.5	9.2	9.7	$77,851	13,093	8.5	14.5	15.1	17.8	15.7	8.0	6.3	4.0	4.5	2.9	2.7	$5,211	1,816	49.0	27.3	12.5	6.8	3.0	0.7	0.7	1
14.8	18.7	11.1	14.6	34,102	4,998	4.2	9.0	11.6	19.5	16.2	9.6	9.9	5.2	6.2	4.2	4.4	1,245	408	36.3	39.2	15.4	6.9	1.5	0.2	0.5	2
18.6	18.3	3.5	3.5	2,820	483	3.3	6.4	16.8	42.1	12.4	6.4	2.5	3.5	3.3	0.8	2.5	38	9	11.1	44.5	11.1	11.1	11.1	11.1	....	3
28.6	15.4	3.5	1.4	483	76	2.6	6.6	10.5	11.9	31.6	15.8	6.6	10.5	1.3	2.6	....	7	3	66.7	33.3	....	....	....	....	....	4
23.2	17.8	3.1	0.8	905	132	5.3	11.4	3.8	6.8	21.2	17.4	10.6	6.8	11.4	5.3	....	15	4	....	25.0	75.0	....	....	....	....	5
14.2	24.2	16.2	15.9	8,668	1,103	2.1	4.1	9.0	10.4	13.9	13.7	10.8	9.6	11.0	8.8	6.6	195	60	11.7	55.0	23.3	6.6	1.7	....	1.7	6
12.8	21.9	16.0	10.8	336	49	14.3	8.2	2.0	14.3	10.2	6.1	10.2	12.2	14.3	4.1	4.1	62	14	14.3	7.2	21.4	35.7	21.4	....	....	7
14.5	24.4	20.5	6.8	472	52	....	5.8	9.6	5.8	26.9	1.9	15.4	5.8	9.6	3.8	15.4	20	[illegible]	....	83.3	....	16.7	....	....	....	8
12.5	15.9	10.6	21.3	12,145	1,674	4.9	9.5	13.4	13.9	18.9	10.5	7.9	3.9	5.9	4.1	7.1	234	75	41.4	25.3	20.0	12.0	1.3	....	....	9
15.9	15.9	12.3	5.9	786	127	11.0	11.8	17.3	6.3	22.1	5.5	4.7	5.5	10.2	3.2	2.4	129	45	46.7	35.6	13.3	4.4	....	....	....	10
17.9	18.0	6.7	7.8	7,487	1,302	4.6	13.3	10.0	29.9	14.0	5.9	14.8	3.1	2.6	1.6	0.2	545	192	43.8	41.7	10.9	3.1	....	....	0.5	11
10.3	9.0	7.0	5.2	2,511	540	17.8	23.9	15.4	17.0	10.9	7.2	3.0	2.0	1.7	0.2	0.9	651	265	63.0	21.9	12.1	1.9	0.7	....	0.4	12
20.4	10.9	1.5	....	131	26	7.7	26.9	7.7	19.2	11.5	15.4	3.9	....	7.7	....	....	9	4	75.0	25.0	....	....	....	....	....	13
9.7	9.5	10.0	8.2	311	75	25.3	30.7	14.7	8.0	9.4	8.0	1.3	....	1.3	1.3	....	64	30	73.3	23.4	3.3	....	....	....	....	14
7.6	9.2	23.5	22.4	365	73	21.9	31.5	6.9	8.2	13.7	2.8	5.5	4.1	2.7	....	2.7	22	7	42.8	28.6	28.6	....	....	....	....	15
7.8	12.9	2.7	2.1	145	33	18.2	30.3	15.1	27.3	6.1	....	....	....	....	....	3.0	70	25	56.0	32.0	12.0	....	....	....	....	16
21.7	12.8	5.5	0.8	698	148	16.9	20.3	17.6	18.9	11.5	6.7	4.0	1.4	2.0	....	0.7	75	31	58.1	29.0	12.9	....	....	....	....	17
5.5	5.1	3.9	0.6	184	47	25.5	21.3	19.2	21.3	10.6	....	....	2.1	....	....	....	169	68	63.2	7.4	27.9	....	1.5	....	....	18
6.3	4.4	4.7	1.9	160	33	12.1	18.2	27.3	12.1	18.2	3.0	3.0	6.1	....	....	....	70	30	70.0	20.0	....	6.7	....	....	3.3	19
8.8	8.3	4.9	4.6	185	44	22.7	22.7	18.2	13.6	6.8	11.4	....	4.6	....	....	....	136	56	64.3	25.0	5.3	3.6	1.8	....	....	20
17.7	10.9	1.7	1.7	332	61	3.3	16.4	13.1	29.5	9.8	18.2	4.9	1.6	1.6	....	1.6	36	14	50.0	42.9	....	7.1	....	....	....	21
16.8	14.3	7.0	5.1	32,349	6,208	10.8	18.4	18.9	17.1	15.7	6.7	3.9	2.9	2.9	1.6	1.1	1,825	669	54.7	23.6	11.1	6.9	2.2	0.9	0.6	22
14.7	17.6	11.6	6.2	5,061	984	13.3	18.2	17.9	17.9	14.9	5.4	3.4	2.8	3.7	1.4	1.1	151	60	55.0	31.6	6.7	3.3	1.7	1.7	....	23
17.2	13.2	10.1	1.3	3,282	700	12.0	22.3	30.4	15.9	9.3	2.7	2.3	1.3	1.7	0.7	1.4	158	65	56.9	24.6	13.9	3.1	1.5	....	....	24
16.6	17.6	8.2	10.3	4,503	800	11.4	16.4	17.8	18.1	11.7	6.0	5.2	4.1	4.1	3.8	1.4	234	82	46.3	31.7	9.8	8.5	3.7	....	....	25
18.3	14.1	5.0	4.9	2,840	568	9.7	18.5	18.3	18.0	21.1	6.9	3.3	1.6	1.6	0.7	0.3	144	56	62.5	17.9	10.7	5.3	1.8	1.8	....	26
17.2	9.9	1.2	0.3	1,737	353	12.2	20.1	15.9	16.4	18.7	7.1	4.8	0.6	2.8	1.1	0.3	76	32	71.9	18.7	9.4	....	....	....	....	27
17.3	17.0	8.9	5.3	2,430	368	4.4	12.8	11.1	16.0	19.0	13.3	7.6	3.8	5.4	2.5	4.1	123	40	37.5	27.5	22.5	7.5	2.5	2.5	....	28
18.1	10.1	2.7	1.3	3,853	752	7.7	18.5	18.4	20.1	16.1	9.7	4.1	2.0	2.0	0.9	0.5	289	104	55.7	23.1	9.6	6.7	2.9	1.0	1.0	29
11.5	7.1	6.1	8.6	2,604	576	15.6	28.3	20.1	13.4	10.3	4.7	2.1	2.1	1.7	0.5	1.2	271	103	60.2	18.4	12.6	5.8	1.0	1.0	1.0	30
33.5	27.3	6.8	2.7	401	53	1.9	....	7.5	22.7	17.0	9.4	9.4	3.8	13.2	15.1	....	56	17	29.4	35.3	5.9	29.4	....	....	....	31
29.2	17.0	0.4	0.3	810	118	5.1	8.5	7.6	14.4	23.7	8.5	7.6	12.7	4.2	3.4	4.3	44	13	30.7	15.4	30.8	15.4	7.7	....	....	32
18.7	13.4	2.9	0.7	1,960	350	4.0	12.0	22.8	18.0	20.9	7.1	2.6	6.9	3.4	2.3	....	109	34	52.9	17.6	5.9	17.7	....	....	5.9	33
17.9	10.9	2.4	0.6	2,868	586	14.3	16.6	16.5	15.5	20.8	7.2	3.4	2.9	1.9	0.7	0.2	170	63	60.3	20.6	7.9	4.8	4.8	1.6	....	34
14.6	11.6	3.7	3.9	3,424	696	16.8	20.5	14.4	18.0	12.8	6.5	3.6	1.7	3.6	1.1	1.0	882	314	51.9	26.8	9.6	7.0	3.2	0.9	0.6	35
9.6	10.9	4.5	5.5	391	90	32.3	29.3	12.1	10.1	7.1	3.1	2.0	....	2.0	....	2.0	135	55	58.2	27.3	7.3	3.6	3.6	....	....	36
5.2	23.3	4.1	1.2	309	75	16.0	24.0	10.7	28.0	1.3	2.7	9.3	....	5.4	1.3	1.3	75	28	64.3	21.4	7.1	3.6	....	3.6	....	37
8.2	7.2	6.5	1.4	137	32	15.6	25.0	34.4	6.3	6.3	9.3	....	....	3.1	....	....	60	23	73.9	8.7	4.4	8.7	4.3	....	....	38
18.8	12.6	5.2	2.1	254	54	18.5	24.1	7.4	20.4	13.0	7.4	5.5	....	3.7	....	....	97	30	30.0	43.3	16.7	6.7	....	....	3.3	39
18.6	11.8	3.6	9.7	50	10	....	30.0	30.0	....	20.0	10.0	....	....	10.0	....	....	59	25	68.0	4.0	16.0	4.0	8.0	....	....	40
13.3	11.8	2.8	2.3	620	132	22.7	20.5	18.2	16.7	8.3	5.3	....	3.0	3.0	1.5	0.8	143	48	41.7	31.3	6.2	12.5	6.2	2.1	....	41
29.3	8.1	2.0	0.4	265	50	10.0	18.0	16.0	20.0	12.0	8.0	2.0	8.0	4.0	2.0	....	49	15	40.0	20.0	20.0	20.0	....	....	....	42
25.3	8.2	2.1	0.3	767	130	3.8	11.6	12.3	23.8	21.5	11.6	6.2	2.3	3.1	2.3	1.5	82	24	33.3	33.3	12.5	8.3	4.2	4.2	4.2	43
16.3	9.6	3.2	5.9	571	114	15.8	18.4	12.2	15.8	21.9	5.3	3.5	0.9	4.4	0.9	0.9	182	66	54.5	31.8	7.6	4.6	1.5	....	....	44
12.4	27.1	17.6	19.1	5,465	651	3.4	5.2	5.8	10.9	18.6	9.8	6.9	9.8	10.5	10.6	8.5	608	160	28.8	22.5	16.9	13.7	13.7	1.9	2.5	45
6.1	19.5	18.4	44.6	365	31	....	....	....	9.7	25.8	....	9.7	19.3	9.7	....	25.8	30	6	....	33.3	33.3	....	16.7	....	16.7	46
19.2	46.4	11.2	5.6	213	26	....	3.8	7.7	15.4	11.5	7.7	....	30.8	7.7	7.7	7.7	46	13	53.8	7.7	7.7	23.1	7.7	....	....	47
9.6	43.6	20.2	5.3	185	26	3.8	3.8	7.7	19.2	15.4	11.6	7.7	15.4	7.7	7.7	....	12	3	33.3	....	33.4	33.3	....	....	....	48
14.4	24.3	12.9	18.0	605	76	1.3	5.3	4.0	9.2	19.7	10.5	6.6	17.1	11.8	10.5	4.0	83	20	15.0	25.0	20.0	20.0	20.0	....	....	49
21.8	24.8	9.8	2.2	25	3	....	....	....	....	33.3	....	....	33.4	33.3	....	....	25	6	16.7	16.7	16.7	33.3	16.6	....	....	50
10.7	27.9	25.4	15.6	91	12	....	....	8.3	8.3	58.4	....	8.3	....	....	8.4	8.3	16	4	....	50.0	....	50.0	....	....	....	51
20.3	12.0	12.8	13.5	154	21	23.8	....	23.8	9.5	23.8	....	....	....	....	4.8	14.3	18	9	55.6	33.3	11.1	....	....	....	....	52
7.1	26.8	21.1	26.8	40	5	....	....	....	....	40.0	....	....	40.0	20.0	....	....	14	3	33.3	....	....	....	33.4	33.3	....	53
8.8	35.3	17.7	11.0	560	70	2.8	5.7	8.6	20.0	11.4	8.6	4.3	5.7	12.9	14.3	5.7	23	9	66.7	22.2	11.1	....	....	....	....	54
17.1	19.6	11.6	27.5	606	86	4.6	3.5	4.6	16.3	36.1	9.3	5.8	3.5	4.6	7.0	4.7	49	11	18.2	....	45.4	9.1	27.3	....	....	55
12.1	27.1	20.9	19.2	2,621	295	3.1	7.1	5.1	7.1	12.5	12.5	8.8	7.8	12.6	13.2	10.2	292	76	26.3	26.3	14.5	11.8	14.5	2.6	4.0	56

[2] Includes Alaska.

TABLE 71.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE SELECTED INDUSTRIES, BY STATES, TERRITO-
CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND AVERAGE WEEKLY EARNINGS, AND NUMBER

SHIRTS.

	STATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	242	$6.33	$10.20	$5.69	$2.31	$106,088	16,765	$29,344	2,876	1.4	4.9	6.0	7.4	9.8	10.4	8.7	8.0	13.6
2	North Atlantic division	153	6.76	10.75	5.93	2.49	56,414	8,344	17,131	1,593	1.6	4.6	5.8	6.0	9.9	8.2	6.2	7.4	15.4
3	Massachusetts	15	7.74	11.98	7.21	3.44	7,868	1,017	1,438	120	......	4.2	4.2	6.6	9.2	3.3	6.7	12.5	17.5
4	New York	83	7.29	10.08	6.29	4.00	28,722	3,938	10,526	1,044	1.5	5.4	7.0	6.7	10.1	9.4	5.1	7.7	16.5
5	New Jersey	14	6.17	10.64	5.48	2.46	7,070	1,146	1,713	161	3.1	2.5	3.7	5.0	8.1	9.3	7.4	5.6	21.1
6	Pennsylvania	41	5.69	12.89	4.96	2.44	12,754	2,243	3,454	268	1.5	3.0	3.0	3.4	10.4	4.9	9.7	5.2	7.1
7	South Atlantic division	16	5.29	8.80	4.66	2.20	26,116	4,939	8,596	977	1.3	6.2	7.0	10.3	10.5	14.1	13.9	9.3	11.1
8	Delaware	3	4.03	8.00	3.98	2.50	718	178	32	4	......	......	......	......	50.0	......	25.0	......	......
9	Maryland	13	5.33	8.80	4.70	2.20	25,398	4,761	8,564	973	1.3	6.2	7.0	10.4	10.3	14.2	13.9	9.3	11.1
10	North Central division	36	8.29	14.07	7.76	3.08	12,328	1,487	1,886	134	......	......	0.7	2.2	7.5	4.5	5.2	6.0	5.2
11	Ohio	8	5.99	14.14	5.53	3.00	749	125	99	7	......	......	14.3	......	......	14.3	......	......	......
12	Illinois	18	8.50	13.39	7.74	3.50	4,734	557	1,018	76	......	......	......	3.9	10.5	2.6	3.9	5.3	6.6
13	Michigan	3	7.11	16.67	6.14	......	462	65	100	6	......	......	......	......	......	......	......	......	......
14	Wisconsin	4	6.58	15.67	5.29	......	158	24	47	3	......	......	......	......	......	......	......	......	......
15	Missouri	3	8.69	14.81	8.39	3.00	6,225	716	622	42	......	......	......	......	4.8	7.1	9.5	9.5	4.8
16	Western division	13	8.32	14.00	7.47	4.00	1,605	193	364	26	......	......	......	......	......	30.8	......	3.9	11.5
17	California	13	8.32	14.00	7.47	4.00	1,605	193	364	26	......	......	......	......	......	30.8	......	3.9	11.5
18	All other states	[1]24	5.34	9.36	5.09	2.12	9,625	1,802	1,367	146	2.1	4.8	7.5	9.6	8.2	11.7	4.8	8.2	18.5

SILK AND SILK GOODS.

	STATE OR TERRITORY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	205	$7.28	$10.57	$6.11	$3.13	$221,980	30,486	$104,502	9,888	2.2	4.0	5.7	5.5	5.7	5.6	6.6	11.6	14.1
2	North Atlantic division	194	7.36	10.64	6.17	3.15	214,268	29,114	101,365	9,526	2.2	3.9	5.7	5.4	5.6	5.4	6.5	11.6	14.0
3	Massachusetts	18	7.62	10.37	6.56	4.29	26,593	3,492	11,396	1,099	0.4	1.3	2.3	5.3	6.6	4.7	9.7	11.3	22.3
4	Rhode Island	4	6.51	9.40	5.90	3.00	905	139	235	25	......	4.0	4.0	12.0	16.0	12.0	4.0	......	20.0
5	Connecticut	6	9.22	11.34	7.37	4.64	33,135	3,592	20,170	1,778	0.4	0.5	1.0	0.8	2.5	4.8	2.1	25.7	16.0
6	New York	43	7.68	12.26	5.68	3.49	37,504	4,884	18,936	1,545	1.2	3.2	4.8	5.2	5.0	4.3	5.1	7.2	10.4
7	New Jersey	55	8.70	10.92	7.30	3.23	52,351	6,015	28,152	2,577	2.3	3.9	4.8	5.4	5.8	6.2	7.0	8.2	14.5
8	Pennsylvania	68	5.80	8.98	5.44	2.87	63,780	10,992	22,476	2,502	4.6	7.7	11.9	8.7	7.4	6.1	8.5	7.9	10.7
9	All other states	[2]11	5.62	8.67	4.88	2.80	7,712	1,372	3,137	362	4.1	8.3	7.2	9.4	7.5	9.9	9.1	10.5	15.5

TOBACCO, CIGARS AND CIGARETTES.

	STATE OR TERRITORY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	9,033	$8.72	$11.14	$5.97	$3.00	$734,971	84,292	$520,028	46,680	2.7	3.7	4.1	5.0	5.7	5.3	6.3	7.4	16.1
2	North Atlantic division	4,014	8.31	10.64	6.18	2.73	364,579	43,860	232,904	21,899	2.7	4.2	4.9	6.3	7.2	6.7	7.4	7.7	14.9
3	Maine	35	11.05	12.21	5.87	......	1,824	165	1,648	135	......	3.7	0.8	3.7	7.4	3.7	7.4	2.2	23.7
4	New Hampshire	29	10.87	11.25	4.33	3.00	837	77	821	73	4.1	9.6	2.7	11.0	6.9	4.1	2.7	2.7	8.2
5	Vermont	16	11.96	12.33	6.50	5.00	622	52	604	49	......	2.1	......	6.1	4.1	4.1	2.0	2.0	10.2
6	Massachusetts	250	13.43	16.01	6.97	3.44	52,207	3,886	44,631	2,787	1.0	1.6	1.4	1.8	2.1	2.2	2.0	2.9	7.8
7	Rhode Island	24	12.23	14.12	6.71	3.00	2,373	194	2,048	145	......	......	0.7	1.4	2.1	3.4	7.6	3.4	11.7
8	Connecticut	137	11.56	12.83	5.95	3.67	7,200	623	6,567	512	1.0	2.7	2.9	2.7	1.8	2.3	3.5	1.2	14.7
9	New York	1,709	8.96	10.56	7.36	3.36	164,527	18,369	99,419	9,414	1.7	4.1	4.8	5.7	7.0	5.8	7.9	8.7	15.9
10	New Jersey	276	6.53	9.71	5.38	2.64	30,673	4,695	13,730	1,414	1.8	6.9	6.8	8.1	9.2	7.4	6.9	6.7	14.1
11	Pennsylvania	1,538	6.60	8.61	5.05	2.54	104,316	15,799	63,436	7,370	5.1	4.8	6.5	8.7	9.3	10.0	9.2	9.3	16.4
12	South Atlantic division	461	9.20	11.95	5.36	3.45	120,404	13,088	93,236	7,801	3.0	2.5	4.1	6.0	4.6	4.7	5.8	7.0	15.5
13	Delaware	14	7.74	9.63	6.70	2.20	1,818	235	876	91	......	5.5	6.6	5.5	9.9	9.9	10.9	9.9	17.6
14	Maryland	207	7.87	9.03	6.23	2.91	13,456	1,709	9,546	1,057	4.0	4.1	4.5	6.1	6.0	11.2	12.2	13.1	16.8
15	District of Columbia	11	9.15	9.32	......	1.00	439	48	438	47	10.6	6.4	2.1	2.1	4.3	6.4	14.9	4.3	17.0
16	Virginia	53	5.04	6.88	4.35	3.95	12,647	2,510	4,993	726	12.4	10.1	14.6	16.5	10.6	5.9	5.6	4.7	7.6
17	West Virginia	48	11.22	14.01	5.76	2.89	9,009	803	7,537	538	0.9	1.7	0.6	1.5	2.4	1.3	13.9	2.8	11.5
18	North Carolina and South Carolina.[4]	14	4.38	5.98	4.06	3.19	5,271	1,204	1,818	304	1.3	4.6	15.8	45.4	11.9	7.9	1.6	5.3	3.6
19	Georgia	23	6.57	10.80	4.39	2.77	2,062	314	1,210	112	0.9	1.8	6.3	7.1	10.7	6.3	7.1	8.0	17.9
20	Florida	91	12.08	13.56	6.70	2.65	75,702	6,265	66,818	4,926	1.7	1.0	2.1	2.4	2.9	3.1	3.7	6.6	17.5
21	North Central division	3,868	9.17	11.24	6.00	2.89	208,297	22,717	161,785	14,397	2.3	3.9	2.9	2.9	4.1	3.7	5.3	7.5	19.2
22	Ohio	732	7.60	10.25	5.89	2.88	50,997	6,714	28,462	2,778	1.7	2.5	2.2	3.4	7.8	5.1	7.4	12.0	21.6
23	Indiana	317	8.32	10.77	5.12	2.86	15,490	1,861	12,012	1,115	3.5	4.9	3.2	2.4	3.0	3.6	6.3	5.9	22.0
24	Illinois	1,001	10.74	11.97	7.43	3.00	51,443	4,790	44,300	3,701	1.8	3.9	2.7	2.5	2.7	2.7	3.9	4.9	17.9
25	Michigan	394	9.38	11.51	5.73	2.81	27,501	2,933	21,853	1,899	1.8	3.3	3.5	3.0	2.9	3.0	4.1	6.9	18.1
26	Wisconsin	418	9.15	10.53	5.06	2.56	15,422	1,686	13,899	1,320	4.3	5.3	2.3	2.8	3.9	4.4	6.7	9.0	21.7
27	Minnesota	210	10.56	11.58	7.03	2.78	11,053	1,047	9,590	828	3.0	5.8	2.8	3.3	3.9	1.9	5.3	8.4	14.5
28	Iowa	258	9.14	10.67	6.02	2.65	10,662	1,167	8,929	837	2.5	4.2	5.0	3.7	3.5	3.6	6.5	6.7	19.8
29	Missouri	306	11.20	12.60	6.10	3.39	16,290	1,455	14,973	1,188	1.2	2.4	2.9	3.3	2.9	4.5	4.5	5.5	16.3
30	North Dakota	13	11.15	12.82	3.00	1.67	290	26	282	22				4.5	4.5				9.1
31	South Dakota	28	10.63	11.86	4.25	3.83	1,095	103	1,032	87	......	1.2	1.2	2.3	4.6	1.1	13.8	4.6	17.2
32	Nebraska	82	9.44	11.19	5.41	2.89	3,293	349	2,897	259	5.4	4.2	3.9	1.5	2.3	3.1	3.1	6.6	17.4
33	Kansas	109	8.12	9.80	5.88	2.76	4,761	586	3,556	363	5.5	8.0	3.3	2.2	6.1	5.5	2.5	8.8	24.0

[1] Includes Colorado, 1; Connecticut, 1; Indiana, 2; Kansas, 2; Kentucky, 2; Maine, 1; Minnesota, 2; Nebraska, 2; North Carolina, 1; Oregon, 1; Rhode Island, 1; Tennessee, 2; Vermont, 2; Virginia, 2; Washington, 2.
[2] Includes California, 2; Delaware, 1; Illinois, 1; Maine, 1; Maryland, 1; New Hampshire, 1; North Carolina, 2; Ohio, 1; Virginia, 1.

RIES, AND GEOGRAPHIC DIVISIONS—PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND OF ALL WAGE-EARNERS AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

SHIRTS.

MEN 16 YEARS AND OVER—continued. Per cent distribution of number by earnings—Continued.				WOMEN 16 YEARS AND OVER.		Per cent distribution of number by earnings.											CHILDREN UNDER 16 YEARS.		Per cent distribution of number by earnings.							
$12 to $15.	$15 to $20.	$20 to $25.	$25 and over	Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over	Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over	
13.1	12.0	3.1	1.6	$75,166	13,206	12.5	13.6	14.6	16.2	13.1	10.7	8.0	5.2	3.8	1.8	0.5	$1,578	683	86.5	11.7	0.9	0.6	0.1	0.2	.....	1
15.9	12.4	4.3	2.3	38,732	6,530	12.5	13.0	13.0	15.6	12.0	11.4	9.2	5.6	4.8	2.2	0.7	551	221	76.0	19.9	1.8	1.4	0.4	0.5	.....	2
17.5	11.6	2.5	4.2	6,399	888	2.9	5.7	7.2	6.1	9.5	22.6	22.3	11.5	8.1	2.6	1.5	31	9	33.3	22.2	11.1	33.4	.....	.....	.....	3
14.8	11.6	2.6	1.6	18,192	2,893	12.7	9.6	12.0	14.1	14.6	11.6	8.2	6.0	6.5	3.6	1.1	4	1	.....	100.0	.....	.....	.....	.....	.....	4
14.9	16.8	1.9	0.6	5,325	972	12.6	11.9	14.8	26.0	11.4	9.2	6.6	4.4	2.4	0.6	0.1	32	13	84.6	15.4	.....	.....	.....	.....	.....	5
19.8	13.4	13.4	5.2	8,816	1,777	16.9	22.6	16.3	17.2	9.5	6.9	5.8	2.5	1.9	0.3	0.1	484	198	77.8	19.7	1.5	.....	0.5	0.5	.....	6
9.8	5.8	0.7	.....	16,664	3,573	14.7	19.0	20.7	19.6	12.9	7.1	3.5	1.8	0.4	0.3	.....	856	389	94.6	5.1	.....	0.3	.....	.....	.....	7
25.0	.....	.....	.....	676	170	22.3	18.8	20.6	19.4	11.8	6.5	.....	.....	0.6	.....	.....	10	4	50.0	50.0	.....	.....	.....	.....	.....	8
9.8	5.8	0.7	.....	15,988	3,403	14.3	19.0	20.7	19.6	13.0	7.1	3.7	1.9	0.4	0.3	.....	846	385	95.1	4.7	.....	0.2	.....	.....	.....	9
9.0	47.0	7.5	5.2	10,402	1,340	1.2	2.5	9.3	11.7	15.1	16.9	16.9	12.5	8.9	3.7	1.3	40	13	.....	100.0	.....	.....	.....	.....	.....	10
14.3	42.8	.....	14.3	647	117	6.0	9.4	15.4	24.8	27.3	10.3	6.0	0.8	.....	.....	.....	3	1	.....	100.0	.....	.....	.....	.....	.....	11
14.5	44.8	5.3	2.6	3,709	479	0.6	3.4	10.0	12.7	12.5	16.7	16.3	10.9	10.2	6.1	0.6	7	2	.....	100.0	.....	.....	.....	.....	.....	12
.....	100.0	.....	.....	362	59	6.8	6.8	15.2	10.2	30.5	13.5	8.5	5.1	1.7	1.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13
.....	100.0	.....	.....	111	21	9.5	9.5	19.0	23.8	14.3	19.1	4.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	14
.....	40.5	14.3	9.5	5,573	664	.....	.....	6.8	8.4	13.4	18.5	20.3	16.9	10.4	3.0	2.3	30	10	.....	100.0	.....	.....	.....	.....	.....	15
.....	34.6	11.5	7.7	1,233	165	8.5	6.1	6.1	9.7	14.5	17.6	6.1	13.3	10.3	6.6	1.2	8	2	.....	.....	100.0	.....	.....	.....	.....	16
.....	34.6	11.5	7.7	1,233	165	8.5	6.1	6.1	9.7	14.5	17.6	6.1	13.3	10.3	6.6	1.2	8	2	.....	.....	100.0	.....	.....	.....	.....	17
11.6	12.3	0.7	.....	8,135	1,598	17.5	13.9	12.8	15.6	15.6	9.8	5.9	4.7	2.2	1.9	0.1	123	58	94.8	5.2	.....	.....	.....	.....	.....	18

SILK AND SILK GOODS.

19.5	15.4	3.1	1.0	$108,596	17,763	7.3	11.8	17.0	16.0	15.0	11.1	7.9	5.9	4.4	2.7	0.9	$8,882	2,835	42.6	33.7	15.1	5.6	2.6	0.3	0.1	1
20.0	15.6	3.1	1.0	104,499	16,924	7.4	11.6	16.5	15.6	14.9	11.4	8.2	6.2	4.5	2.8	0.9	8,404	2,664	41.0	35.2	15.1	5.5	2.7	0.3	0.2	2
23.3	10.6	1.6	0.6	14,261	2,175	3.0	4.6	13.6	19.9	20.8	12.6	10.5	6.7	5.9	2.2	0.2	936	218	7.3	31.2	33.5	21.1	6.9	.....	.....	3
20.0	4.0	4.0	.....	667	113	.....	4.4	8.0	48.7	17.7	3.5	2.7	15.0	.....	.....	.....	3	1	.....	100.0	.....	.....	.....	.....	.....	4
28.9	15.0	1.2	1.1	12,283	1,667	2.3	2.8	3.3	7.5	18.3	26.3	21.8	16.2	0.7	0.6	0.2	682	147	14.3	13.6	31.3	15.6	20.4	4.8	.....	5
17.3	29.0	4.8	2.5	17,944	3,160	8.2	13.6	19.8	19.5	15.0	7.7	5.6	3.5	4.0	2.3	0.8	624	179	24.6	50.8	19.0	2.8	1.1	.....	1.7	6
20.0	15.1	5.8	1.0	23,478	3,215	6.6	9.2	10.4	10.3	13.7	12.3	8.7	8.6	8.2	8.5	3.5	721	223	40.4	39.0	13.9	5.4	0.9	.....	0.4	7
14.0	10.8	1.3	0.4	35,866	6,594	10.2	16.3	22.3	16.3	12.7	8.8	5.1	3.5	3.6	1.0	0.2	5,438	1,896	48.6	35.4	11.5	3.1	1.3	0.1	.....	8
6.6	9.1	2.2	0.6	4,097	830	6.3	17.5	26.6	25.6	15.5	4.9	1.7	0.3	1.1	0.5	.....	478	171	66.7	9.9	15.2	8.2	.....	.....	.....	9

TOBACCO, CIGARS AND CIGARETTES.

22.0	16.7	3.6	1.4	$205,232	34,374	11.0	12.7	16.2	16.1	14.0	11.1	6.3	4.3	4.6	2.7	1.0	$9,711	3,238	50.9	28.2	12.0	5.7	2.2	0.6	0.4	1
19.4	14.0	3.3	1.3	128,475	20,789	9.3	11.5	16.1	15.4	14.9	12.6	6.8	4.7	5.3	2.8	0.6	3,200	1,172	62.4	24.1	7.9	4.2	1.1	0.1	0.2	2
18.5	18.5	6.7	3.7	176	30	.....	10.0	33.4	10.0	30.0	13.3	.....	.....	.....	.....	3.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	3
11.0	28.8	6.8	1.4	13	3	33.3	33.3	.....		.....	33.4	.....	.....	.....	.....	.....	3	1	.....	100.0	.....	.....	.....	.....	.....	4
34.7	34.7			13	2	.....	.....	.....	50.0	.....	.....	50.0	.....	.....	.....	.....	5	1	.....	.....	.....	100.0	.....	.....	.....	5
20.6	35.3	14.3	7.0	7,490	1,074	3.1	6.4	12.9	18.9	25.3	14.2	4.4	2.8	2.8	5.0	4.2	86	25	12.0	68.0	12.0	.....	8.0	.....	.....	6
26.9	33.8	8.3	0.7	322	48	8.3	2.1	14.6	16.7	22.9	10.4	8.3	6.2	4.2	4.2	2.1	3	1	.....	100.0	.....	.....	.....	.....	.....	7
32.2	29.9	5.1	.....	589	99	2.0	5.2	15.2	14.1	25.3	15.2	5.0	3.0	2.0	3.0	.....	44	12	8.3	58.4	8.3	16.7	8.3	.....	.....	8
22.0	13.3	2.3	0.8	64,463	8,763	3.3	6.2	10.5	12.7	16.3	17.3	10.2	8.4	9.6	4.7	0.8	645	192	50.5	26.6	13.5	7.3	1.6	.....	0.5	9
17.6	12.7	1.8	.....	16,267	3,025	16.9	16.1	17.9	15.3	13.1	11.3	5.3	1.6	1.6	0.9	(3)	676	256	55.1	33.6	8.6	2.7	.....	.....	.....	10
14.8	5.3	0.5	0.1	39,142	7,745	14.3	16.4	22.1	17.9	12.4	7.6	3.8	2.0	2.2	1.1	0.2	1,738	684	71.5	17.6	6.0	3.7	1.0	0.1	0.1	11
19.9	19.4	4.4	3.1	25,021	4,665	16.2	14.3	20.2	15.3	14.0	7.2	4.7	2.4	1.3	2.7	1.7	2,147	622	41.8	21.2	20.3	11.6	3.5	1.4	0.2	12
14.3	8.8	1.1	.....	931	139	4.3	11.5	17.3	13.7	26.6	11.5	3.6	4.3	5.0	2.2	.....	11	5	100.0	.....	.....	.....	.....	.....	.....	13
14.9	6.8	0.3	.....	3,779	607	6.4	5.9	24.9	13.7	13.0	11.2	9.1	8.7	4.0	2.6	0.5	131	45	60.0	28.9	8.9	.....	2.2	.....	.....	14
25.5	2.1	4.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	100.0	.....	.....	.....	.....	.....	.....	15
4.7	6.8	0.4	0.1	6,561	1,507	25.3	20.7	15.9	15.3	11.3	7.4	3.0	0.9	0.2	.....	.....	1,093	277	29.2	24.2	18.4	17.3	7.6	3.3	.....	16
19.7	33.8	8.4	1.5	1,417	246	9.8	7.3	16.7	14.6	22.4	12.2	8.9	4.9	0.8	2.4	.....	55	19	57.9	15.8	21.0	5.3	.....	.....	.....	17
1.0	1.3	0.3	.....	2,719	670	21.2	19.4	29.1	21.2	6.1	2.6	0.2	0.2	.....	.....	.....	734	230	45.2	19.6	26.1	9.1	.....	.....	.....	18
10.7	14.3	8.9	.....	791	180	33.3	13.3	16.7	15.6	5.5	7.8	5.0	2.8	.....	.....	.....	61	22	63.6	9.1	27.3		.....	.....	.....	19
24.7	23.9	5.6	4.8	8,823	1,316	7.9	10.0	19.8	13.4	19.7	5.9	6.2	1.7	1.8	7.8	5.8	61	23	73.9	8.7	4.4	8.7	.....	.....	4.3	20
27.5	17.6	2.7	0.4	43,342	7,225	10.6	14.4	14.0	18.3	10.9	10.0	6.5	5.1	5.4	3.0	1.8	3,170	1,095	48.8	34.9	11.0	2.5	2.3	0.5	.....	21
26.8	8.4	1.0	0.1	21,922	3,723	11.9	12.5	14.6	21.1	9.9	8.9	6.7	5.5	5.6	2.3	1.0	613	213	42.2	34.3	20.2	0.5	2.8	.....	.....	22
28.7	15.1	1.1	0.3	3,049	596	13.9	16.1	15.8	14.8	16.1	12.3	6.2	2.2	1.3	0.5	0.8	429	150	51.4	39.3	7.3	1.3	0.7	.....	.....	23
27.9	25.2	3.5	0.4	6,505	876	8.0	8.3	11.4	12.4	13.5	13.4	5.9	4.5	7.2	8.0	7.4	638	213	40.8	42.2	9.9	3.8	1.9	1.4	.....	24
32.3	17.1	3.2	0.8	5,381	939	7.5	21.2	14.2	16.5	9.1	10.4	8.3	7.0	3.5	1.9	0.4	267	95	52.6	32.6	9.5	5.3	.....	.....	.....	25
24.8	11.9	2.2	0.7	1,188	235	6.4	31.5	13.6	18.3	10.6	6.4	5.1	2.1	4.7	1.3	.....	335	131	63.4	32.8	3.0	.....	0.8	.....	.....	26
24.6	18.4	7.1	1.0	1,413	201	3.5	7.5	14.4	20.9	16.9	8.9	6.5	3.5	5.0	7.9	5.0	50	18	61.1	38.9	.....	.....	.....	.....	.....	27
25.1	18.6	0.8	.....	1,534	255	9.0	23.5	12.2	15.3	7.4	7.1	5.9	5.1	9.0	3.9	1.6	199	75	64.0	22.6	8.0	2.7	2.7	.....	.....	28
27.2	23.2	5.3	0.8	927	152	5.3	15.1	14.5	15.8	21.0	12.5	3.3	4.6	2.6	3.3	2.0	390	115	33.9	33.0	18.3	6.1	7.8	0.9	.....	29
45.5	36.4	.....	.....	[illegible]	1	.....	100.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	3	100.0	.....	.....	.....	.....	.....	.....	30
29.9	21.8	2.3	.....	17	4	25.0	.....	.....	75.0	.....	.....	.....	.....	.....	.....	.....	46	12	25.0	33.4	25.0	8.3	8.3	.....	.....	31
28.2	24.3	.....	.....	292	54	38.9	13.0	11.1	3.7	.....	3.7	11.1	.....	9.3	1.8	7.4	104	36	61.1	25.0	8.3	.....	2.8	2.8	.....	32
19.5	13.5	0.8	0.3	1,111	189	10.6	13.7	13.2	17.5	4.8	15.3	2.1	6.9	14.3	1.1	0.5	94	34	61.8	32.4	.....	2.9	.....	2.9	.....	33

[3] Less than one-tenth of 1 per cent.
[4] Combined to prevent disclosure of figures of individual establishments; includes North Carolina, 8; South Carolina, 6.

TABLE 71.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE SELECTED INDUSTRIES, BY STATES, TERRITO-
CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND AVERAGE WEEKLY EARNINGS, AND NUMBER

TOBACCO, CIGARS AND CIGARETTES—Continued.

	TATE OR TERRITORY.	Number of establishments.	AVERAGE WEEKLY EARNINGS.				TOTAL.		MEN 16 YEARS AND OVER.										
			All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Earnings.	Number.	Earnings.	Number.	Per cent distribution of number by earnings.								
											Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
34	South Central division	244	$6.59	$10.24	$4.69	$3.31	$18,345	2,782	$10,509	1,026	6.3	4.1	4.5	4.7	5.3	5.5	7.9	9.6	15.4
35	Kentucky	102	6.29	9.41	4.91	2.86	5,731	911	3,039	323	5.6	2.5	3.4	3.1	6.5	7.7	13.0	11.5	22.0
36	Tennessee	23	10.06	11.64	8.00	2.89	1,197	119	1,094	94	4.2	3.2	3.2	1.1	2.1	1.1	3.2	5.3	21.3
37	Alabama	22	9.00	9.90	3.00	2.38	1,224	136	1,178	119	5.0	5.0	3.4	7.6	5.9	4.2	7.6	15.1	13.5
38	Louisiana and Mississippi.[1]	11	4.97	7.87	4.52	3.84	6,141	1,236	1,518	193	14.0	5.7	9.8	9.3	6.2	11.9	9.8	11.4	11.4
39	Arkansas	16	11.62	13.80	12.00	3.00	755	65	704	51	2.0	......	......	2.0	5.9	......	5.9	3.9	3.9
40	Indian Territory	3	11.30	14.71	4.00	2.00	113	10	103	7	14.3	......	......	......	......	......	......	......	......
41	Oklahoma	18	9.04	9.89	7.50	2.50	416	46	376	38	5.3	7.9	5.3	2.6	5.3	......	7.9	5.3	18.4
42	Texas	49	10.69	12.42	5.18	2.92	2,768	259	2,497	201	3.0	5.5	3.5	4.0	3.5	1.0	1.0	6.4	9.9
43	Western division [2]	446	12.65	13.87	6.70	3.94	23,346	1,845	21,594	1,557	0.7	1.5	3.7	3.1	7.2	4.2	2.3	3.3	6.5
44	Montana	32	15.98	17.15	3.00	4.22	1,790	112	1,749	102	......	2.0	1.0	2.0	2.0	7.8	......	1.9	1.0
45	Idaho	12	16.60	19.26	5.83	4.75	863	52	809	42	......	......	......	......	......	......	2.4	......	......
46	Wyoming	7	12.52	14.11	7.50	2.50	288	23	268	19	......	5.2	10.5	......	5.3	......	5.3	......	5.3
47	Colorado	61	14.31	15.85	7.98	4.13	5,695	398	5,135	324	......	1.2	1.2	1.2	1.6	1.2	1.6	1.9	4.0
48	New Mexico	4	11.85	12.58	......	3.00	154	13	151	12	......	......	......	......	......	......	8.3	8.3	50.0
49	Arizona	7	12.50	14.41	5.00	4.50	875	70	807	56	......	......	1.8	......	......	3.6	3.6	3.6	23.2
50	Utah	16	13.81	16.20	6.50	4.00	718	52	664	41	......	......	4.9	4.9	2.4	2.4	......	7.3	2.4
51	Nevada	5	17.26	17.86	......	4.00	397	23	393	22	......	9.1	4.6	4.5	......	......	......	......	......
52	Washington [2]	65	14.26	14.62	6.13	......	2,696	189	2,647	181	......	......	......	2.8	3.3	0.6	0.6	1.1	7.2
53	Oregon	24	13.79	15.32	6.00	4.20	924	67	873	57	1.7	......	1.7	......	8.8	1.7	5.3	1.7	1.8
54	California	213	10.57	11.55	6.27	3.61	8,946	846	8,098	701	1.4	2.1	6.4	4.9	13.1	7.0	3.0	5.0	7.4

WOOLEN GOODS.

	State or territory.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	366	$8.23	$9.29	$6.91	$3.83	$361,159	43,881	$252,597	27,202	1.6	1.4	2.9	4.4	10.7	16.4	12.6	15.1	16.7
2	North Atlantic division	259	8.53	9.42	7.23	4.32	326,260	38,253	232,337	24,660	1.3	1.0	2.4	4.2	9.9	16.6	13.3	15.1	17.4
3	Maine	29	8.39	9.13	7.00	4.19	21,608	2,576	15,639	1,713	3.5	1.2	3.0	3.7	8.2	14.6	12.8	19.8	17.6
4	New Hampshire	15	8.96	9.93	7.24	4.70	18,486	2,064	13,346	1,344	1.0	1.0	2.4	3.4	7.0	15.0	10.3	17.9	21.6
5	Vermont	11	8.49	9.11	7.32	4.02	18,597	2,191	13,870	1,522	1.3	1.3	2.2	4.1	10.4	17.5	14.4	15.4	17.3
6	Massachusetts	105	8.59	9.40	7.35	4.59	176,139	20,514	125,202	13,318	1.5	1.0	2.3	4.6	9.8	17.7	14.5	12.7	15.9
7	Rhode Island	21	9.09	9.88	7.80	3.96	26,446	2,908	19,115	1,935	0.1	0.2	2.4	4.4	7.2	13.6	10.5	18.6	25.4
8	Connecticut	14	8.56	9.66	7.05	4.06	15,622	1,826	11,215	1,161	1.9	1.3	3.0	4.3	12.1	17.9	12.5	10.9	19.3
9	New York	14	8.32	9.35	6.77	4.76	14,369	1,726	10,243	1,096	0.5	0.5	3.3	2.6	3.0	25.8	9.3	23.9	12.8
10	New Jersey	5	7.35	8.25	6.78	3.60	5,935	807	3,686	447	......	2.2	4.5	4.9	40.3	7.1	9.2	7.8	8.3
11	Pennsylvania	45	7.98	9.43	6.65	4.00	29,058	3,641	20,021	2,124	0.9	1.1	1.4	3.0	12.5	11.5	12.5	20.4	20.1
12	South Atlantic division	20	5.99	6.97	5.30	2.75	6,906	1,153	4,793	688	3.3	4.4	9.0	4.1	28.1	25.0	6.4	9.7	4.7
13	Maryland	4	6.30	7.47	5.80	2.75	5,683	902	3,819	511	......	1.6	5.1	1.4	31.9	29.9	8.0	11.0	5.1
14	Virginia	3	4.71	5.83	4.33	2.50	66	14	35	6	......	16.7	......	......	66.7	16.6	......	......	......
15	West Virginia	4	6.16	8.21	3.94	1.50	271	44	197	24	......	4.2	8.3	4.2	16.7	16.7	4.2	20.8	4.1
16	North Carolina	6	5.11	5.56	3.45	4.50	506	99	428	77	2.6	3.9	36.3	16.9	15.6	14.3	2.6	5.2	2.6
17	Georgia	3	4.04	4.49	2.75	......	380	94	314	70	30.0	24.3	8.6	10.0	14.3	4.3	......	2.8	4.3
18	North Central division	52	6.75	8.48	5.39	3.26	14,334	2,122	8,231	971	3.6	5.5	7.5	7.6	10.2	13.7	8.0	13.9	11.2
19	Ohio	13	6.76	8.71	5.11	3.25	2,095	310	1,254	144	1.4	2.1	7.6	4.1	9.0	18.1	14.6	16.7	10.4
20	Indiana	8	6.36	8.07	5.29	4.09	5,540	871	2,744	340	4.1	8.2	8.2	9.7	11.5	13.5	8.0	10.6	7.9
21	Illinois	7	7.25	8.77	5.69	2.75	3,239	447	2,016	230	5.2	2.2	3.9	5.7	15.2	12.2	5.2	13.9	16.5
22	Michigan	8	7.50	9.64	6.03	2.80	893	119	511	53	......	7.5	5.7	3.8	3.8	20.8	7.5	9.4	18.9
23	Wisconsin	7	6.61	8.20	5.20	3.05	1,691	256	1,107	135	5.2	7.4	12.6	8.9	3.7	11.1	8.2	15.6	8.1
24	Minnesota	5	6.88	7.70	4.78	......	220	32	177	23	......	8.7	......	21.7	17.4	8.7	4.4	13.1	13.0
25	Iowa	4	7.54	9.17	5.78	3.00	656	87	422	46	......	2.2	10.9	6.5	2.2	10.9	4.3	30.4	10.9
26	South Central division	23	4.48	6.62	4.37	2.53	5,987	1,336	2,501	378	12.7	12.7	14.6	8.2	13.2	4.0	2.9	12.2	8.9
27	Kentucky	10	5.98	6.77	6.58	2.88	867	145	318	47	......	10.6	14.9	21.3	21.3	6.4	4.3	14.9	......
28	Tennessee	13	4.30	6.60	4.06	2.50	5,120	1,191	2,183	331	14.5	13.0	14.5	6.3	12.1	3.6	2.7	11.8	10.3
29	Western division	3	10.38	12.72	8.34	4.50	2,968	286	1,781	140	2.9	1.4	......	2.1	4.3	5.0	0.7	40.7	5.7
30	California	3	10.38	12.72	8.34	4.50	2,968	286	1,781	140	2.9	1.4	......	2.1	4.3	5.0	0.7	40.7	5.7
31	All other states	[3]9	6.44	8.09	5.33	2.70	4,704	731	2,954	365	......	1.6	2.2	7.1	32.1	8.2	8.0	22.2	13.4

WORSTED GOODS.

	State or territory.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	United States	108	$7.91	$9.83	$6.78	$3.82	$362,122	45,803	$208,778	21,243	1.7	1.4	4.6	7.7	9.5	12.4	10.3	8.5	14.6
2	North Atlantic division	104	7.91	9.82	6.78	3.82	360,001	45,527	207,446	21,117	1.7	1.4	4.6	7.7	9.5	12.5	10.3	8.4	14.6
3	Maine	4	7.83	9.25	7.30	3.47	12,193	1,558	7,316	791	1.1	2.4	4.0	7.1	10.5	17.6	7.6	8.9	13.4
4	Massachusetts	39	7.94	9.58	6.68	4.38	171,306	21,576	101,060	10,552	2.2	1.7	4.8	8.2	7.5	12.9	11.4	9.3	15.6
5	Rhode Island	31	8.48	10.48	7.38	3.59	111,795	13,180	66,577	6,352	1.2	0.7	4.0	6.7	12.1	11.4	9.0	6.3	13.8
6	New York	4	7.52	8.90	6.21	3.70	14,133	1,880	8,869	996	2.7	1.2	5.0	7.1	11.6	17.8	10.1	9.2	15.8
7	New Jersey	5	5.45	8.68	4.90	2.82	6,418	1,178	2,924	337	......	8.3	14.8	9.8	11.6	6.8	4.8	7.1	5.9
8	Pennsylvania	21	7.17	9.91	6.43	3.70	44,156	6,155	20,700	2,089	1.0	1.0	4.1	8.2	10.3	10.0	11.0	10.7	12.9
9	All other states	[4]4	7.68	10.57	5.69	3.19	2,121	276	1,332	126	......	0.8	4.0	5.5	9.5	4.0	8.7	5.6	28.6

[1] Includes Mississippi, 1. [2] Includes Alaska, 1. [3] Includes Arkansas, 1; Delaware, 1; Mississippi, 1; Missouri, 2; North Dakota, 1; Oregon, 2; Utah, 1.

RIES, AND GEOGRAPHIC DIVISIONS—PER CENT DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND OF ALL WAGE-EARNERS AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

TOBACCO, CIGARS AND CIGARETTES—Continued.

Men 16 years and over—continued. Per cent distribution of number by earnings—Continued. $12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	Women 16 years and over. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Children under 16 years. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
19.0	14.6	2.1	1.0	$6,894	1,471	21.3	16.9	17.1	16.7	14.1	7.5	3.2	1.6	0.8	0.6	0.2	$942	285	39.6	31.6	14.0	8.8	3.2	....	2.8	34
18.6	4.9	1.2	....	2,420	493	19.5	15.0	17.0	17.0	14.0	8.1	4.1	3.1	1.4	0.6	0.2	272	95	51.6	30.5	11.6	3.2	3.1	....	....	35
28.7	26.6	....	....	48	6	....	....	16.7	....	33.3	16.7	....	16.7	....	....	16.6	55	19	47.4	31.6	10.5	10.5	....	....	....	36
15.1	13.4	4.2	....	27	9	33.4	33.3	22.2	11.1	....	....	....	....	....	....	....	19	8	62.5	37.5	....	....	....	....	....	37
7.3	....	1.6	1.6	4,116	911	22.9	16.6	17.7	17.4	13.8	7.4	3.0	0.8	0.3	0.1	....	507	132	28.8	28.0	18.2	15.1	3.8	....	6.1	38
31.4	39.2	1.9	3.9	12	1	....	....	....	....	....	....	....	....	....	100.0	....	39	13	15.4	76.9	7.7	....	....	....	....	39
14.3	28.6	42.8	....	8	2	....	50.0	....	50.0	....	....	....	....	....	....	....	2	1	100.0	....	....	....	....	....	....	40
28.9	13.1	....	....	30	4	....	....	....	25.0	50.0	....	....	....	....	25.0	....	10	4	50.0	25.0	25.0	....	....	....	....	41
23.9	32.8	3.0	2.5	233	45	13.3	42.2	6.7	2.2	20.0	4.5	....	....	2.2	6.7	2.2	38	13	53.8	30.8	7.7	....	7.7	....	....	42
19.7	34.1	10.9	2.8	1,500	224	0.5	5.8	11.2	21.9	23.2	7.6	12.9	3.1	8.9	2.7	2.2	252	64	17.2	42.2	12.5	17.2	6.2	3.1	1.6	43
7.8	50.0	15.7	8.8	3	1	....	100.0	....	....	....	....	....	....	....	....	....	38	9	44.5	11.1	22.2	....	11.1	....	11.1	44
9.5	33.3	47.6	7.2	35	6	....	....	16.7	33.3	33.3	16.7	....	....	....	....	....	19	4	25.0	....	....	50.0	25.0	....	....	45
10.5	31.6	15.8	10.5	15	2	....	....	....	....	50.0	....	....	50.0	....	....	....	5	2	100.0	....	....	....	....	....	....	46
28.1	46.9	9.6	1.5	527	66	....	3.0	1.5	18.2	13.6	4.6	28.8	3.0	18.2	6.1	3.0	33	8	....	37.5	25.0	37.5	....	....	....	47
8.4	25.0	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	1	....	100.0	....	....	....	....	....	48
14.3	42.9	3.5	3.5	50	10	....	....	....	100.0	....	....	....	....	....	....	....	18	4	....	50.0	....	25.0	25.0	....	....	49
4.9	24.4	34.2	12.2	26	4	....	25.0	....	....	25.0	25.0	....	25.0	....	....	....	28	7	14.3	42.8	14.3	14.3	....	14.3	....	50
13.6	9.1	36.4	22.7	....	....	....	....	....	....	....	....	....	....	....	....	....	4	1	....	....	100.0	....	....	....	....	51
33.7	43.6	5.5	1.6	49	8	....	12.5	....	62.5	12.5	....	....	....	....	....	12.5	....	....	....	....	....	....	....	....	....	52
12.3	38.6	24.6	1.8	30	5	....	....	20.0	40.0	20.0	....	....	....	20.0	....	....	21	5	....	20.0	40.0	40.0	....	....	....	53
17.1	24.0	7.4	1.2	765	122	0.8	6.6	18.0	14.8	30.3	9.8	8.2	2.5	5.7	1.7	1.6	83	23	13.0	69.6	....	8.7	4.4	4.3	....	54

WOOLEN GOODS.

11.8	4.9	1.0	0.5	$100,282	14,515	3.4	6.0	12.5	16.0	16.5	13.7	9.7	9.5	9.1	3.1	0.5	$8,280	2,164	21.5	35.1	24.7	12.4	4.6	1.3	0.4	1
12.3	5.0	1.0	0.5	87,374	12,077	2.1	3.5	10.7	15.8	16.9	15.2	11.0	10.7	10.1	3.5	0.5	6,549	1,516	6.6	34.8	32.3	17.4	6.5	1.8	0.6	2
11.4	3.4	0.7	0.1	5,856	836	4.1	3.7	12.7	15.8	19.7	12.3	8.5	8.4	10.0	4.2	0.6	113	27	3.7	37.0	48.2	7.4	3.7	....	....	3
14.1	5.6	0.7	....	4,999	620	2.7	2.7	12.5	15.4	16.9	15.8	8.3	9.0	10.6	4.2	1.9	141	30	3.4	23.3	30.0	23.3	13.3	6.7	....	4
13.2	2.5	0.3	0.1	4,518	617	1.3	5.8	11.5	16.2	16.7	10.7	12.6	10.1	11.7	3.2	0.2	209	52	1.9	55.8	26.9	7.7	5.8	1.9	....	5
13.4	5.0	0.9	0.7	47,630	6,476	1.9	3.5	9.4	15.6	15.5	14.5	12.6	11.3	10.7	4.5	0.5	3,307	720	6.1	25.8	33.3	22.2	9.5	2.0	1.1	6
9.5	7.1	0.7	0.3	7,062	905	....	....	11.1	13.2	15.8	16.2	11.5	13.0	18.8	0.3	0.1	269	68	7.4	42.6	48.5	1.5	....	....	....	7
10.3	5.0	1.1	0.4	4,025	571	2.8	4.5	14.2	10.7	20.3	15.2	10.2	10.2	8.6	2.6	0.7	382	94	9.6	29.8	43.6	8.5	7.4	....	1.1	8
10.5	5.3	2.2	0.3	3,793	560	1.8	6.4	14.4	16.8	17.7	21.1	6.8	5.4	6.2	3.4	....	333	70	1.4	25.7	31.4	21.4	7.2	12.9	....	9
7.6	3.8	2.5	1.8	2,033	300	....	6.3	26.4	13.3	14.3	17.0	11.3	5.3	3.7	1.7	0.7	216	60	....	88.3	....	11.7	....	....	....	10
9.5	5.7	1.0	0.4	7,458	1,122	3.2	2.9	7.6	21.1	22.5	19.6	6.4	12.8	3.0	0.9	....	1,579	395	9.6	42.6	29.6	15.2	2.5	0.5	....	11
3.3	1.5	0.4	0.1	1,733	327	7.3	14.4	15.6	18.4	32.7	9.8	1.8	....	....	....	....	380	138	48.6	37.7	11.6	1.4	0.7	....	....	12
3.5	1.9	0.4	0.2	1,501	259	....	7.7	17.8	22.0	38.6	11.6	2.3	....	....	....	....	363	132	47.7	39.4	10.6	1.5	0.8	....	....	13
....	....	....	....	26	6	33.3	16.7	....	....	50.0	....	....	....	....	....	....	5	2	100.0	....	....	....	....	....	....	14
20.8	....	....	....	71	18	11.1	66.6	....	5.6	16.7	....	....	....	....	....	....	3	2	100.0	....	....	....	....	....	....	15
....	....	....	....	69	20	35.0	35.0	10.0	5.0	5.0	10.0	....	....	....	....	....	9	2	....	....	100.0	....	....	....	....	16
....	....	1.4	....	66	24	54.1	29.2	12.5	4.2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	17
10.1	6.7	1.3	0.7	5,953	1,105	8.8	18.4	23.6	16.9	12.2	5.9	4.8	3.8	4.5	1.0	0.1	150	46	8.7	80.4	6.5	4.4	....	....	....	18
9.0	5.6	1.4	....	828	162	6.2	24.7	22.8	13.6	14.8	7.4	1.8	2.5	6.2	....	....	13	4	....	75.0	25.0	....	....	....	....	19
9.7	6.2	1.8	0.6	2,751	520	12.5	20.4	19.4	16.5	13.5	6.0	5.0	3.6	2.9	0.2	....	45	11	....	72.7	9.1	18.2	....	....	....	20
11.3	6.1	1.3	1.3	1,212	213	7.5	9.9	25.4	21.6	13.1	4.7	4.2	3.8	8.4	1.4	....	11	4	50.0	50.0	....	....	....	....	....	21
13.2	7.5	1.9	....	368	61	3.3	13.1	29.5	11.5	14.8	3.3	4.9	9.8	4.9	3.3	1.6	14	5	40.0	60.0	....	....	....	....	....	22
9.6	8.1	....	1.5	520	100	3.0	17.0	42.0	18.0	....	5.0	4.0	3.0	3.0	5.0	....	64	21	....	95.2	4.8	....	....	....	....	23
13.0	....	....	....	43	9	11.1	44.5	....	....	22.2	22.2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	24
6.5	15.2	....	....	231	40	....	17.5	22.5	20.0	5.0	7.5	20.0	5.0	2.5	....	....	3	1	....	100.0	....	....	....	....	....	25
8.7	1.6	0.3	....	2,526	578	18.7	31.5	25.1	6.6	6.2	0.9	0.9	4.6	4.8	0.7	....	960	380	69.2	25.8	5.0	....	....	....	....	26
2.1	2.1	2.1	....	474	72	2.8	18.1	12.5	9.7	8.3	7.0	6.9	9.7	25.0	....	....	75	26	19.2	80.8	....	....	....	....	....	27
9.7	1.5	....	....	2,052	506	20.9	33.4	26.9	6.1	5.9	....	....	4.0	2.0	0.8	....	885	354	72.9	21.7	5.4	....	....	....	....	28
10.7	8.6	10.0	7.9	1,151	138	7.3	1.5	0.7	....	31.2	13.0	7.2	14.5	13.0	6.5	5.1	36	8	....	....	100.0	....	....	....	....	29
10.7	8.6	10.0	7.9	1,151	138	7.3	1.5	0.7	....	31.2	13.0	7.2	14.5	13.0	6.5	5.1	36	8	....	....	100.0	....	....	....	....	30
2.7	2.2	0.3	....	1,545	290	0.4	4.1	23.5	46.2	13.1	11.7	0.3	0.7	....	....	....	205	76	40.8	59.2	....	....	....	....	....	31

WORSTED GOODS.

17.9	9.6	1.2	0.6	$136,451	20,138	2.6	3.2	13.8	22.6	23.1	9.5	7.7	6.5	6.8	3.3	0.9	$16,893	4,422	20.9	38.3	29.2	7.7	3.3	0.5	0.1	1
17.9	9.6	1.2	0.6	135,745	20,014	2.6	3.1	13.7	22.7	23.2	9.5	7.7	6.5	6.8	3.3	0.9	16,810	4,396	20.9	38.2	29.2	7.7	3.3	0.6	0.1	2
20.6	6.7	0.1	....	4,221	578	2.8	1.5	9.5	19.9	15.4	14.2	9.2	9.3	11.8	5.2	1.2	656	189	19.6	47.6	28.6	4.2	....	....	....	3
16.5	8.4	1.1	0.4	63,837	9,562	3.9	2.8	11.9	21.9	24.8	10.4	8.3	7.5	6.3	1.9	0.3	6,409	1,462	9.6	18.5	50.6	14.0	5.4	1.5	0.4	4
21.0	11.2	1.6	1.0	40,304	5,461	0.8	1.6	10.8	20.4	26.1	9.7	7.9	6.3	7.8	6.4	2.2	4,914	1,367	28.1	50.0	18.2	2.2	1.5	....	....	5
13.2	5.9	0.4	....	4,935	795	4.3	4.2	23.3	25.4	11.3	10.4	8.6	3.1	8.0	1.3	0.1	329	89	21.4	49.4	29.2	....	....	....	....	6
16.0	14.0	0.3	0.6	2,649	541	....	10.9	35.9	49.3	3.5	0.4	....	....	....	....	....	845	300	42.0	50.0	7.3	0.7	....	....	....	7
16.8	12.9	0.9	0.2	19,799	3,077	1.6	5.0	19.1	24.6	21.3	7.0	6.2	5.1	6.9	2.6	0.6	3,657	989	21.2	44.5	19.8	9.6	4.7	0.2	....	8
19.0	14.3	....	....	706	124	7.3	16.1	33.1	2.4	8.1	5.6	8.9	14.5	4.0	....	....	83	26	30.8	53.8	15.4	....	....	....	....	9

[4] Includes Connecticut, 2; West Virginia, 1; Wisconsin, 1.

TABLE 72.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE STATES, BY SELECTED INDUSTRIES—PER CENT AVERAGE WEEKLY EARNINGS, AND NUMBER OF ALL WAGE-EARNERS

ALABAMA.

	INDUSTRY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	786	$7.65	$8.30	$4.46	$2.85	$200,255	26,191	$186,433	22,459	4.4	4.6	9.4	10.1	19.3	14.8	6.9	6.5	7.4
2	Seven selected industries.	307	7.58	8.34	4.42	2.84	156,344	20,637	143,974	17,258	4.2	4.5	9.5	9.6	18.2	16.2	7.3	6.6	7.7
3	Cars and general shop construction and repairs by steam railroad companies.	11	10.92	10.93	3.29	6.75	55,921	5,121	55,871	5,110	0.6	0.7	1.6	3.8	13.6	19.5	6.8	6.6	13.8
4	Coke	12	7.72	7.77	......	3.40	15,930	2,064	15,845	2,039	3.9	7.7	9.0	13.1	15.1	12.1	10.6	7.8	9.5
5	Cotton goods	19	4.61	5.77	4.43	2.83	27,638	5,995	15,486	2,684	8.2	10.9	24.9	15.0	14.4	10.2	5.5	5.3	2.3
6	Foundry and machine shop products.	20	9.42	9.44	......	2.33	12,293	1,305	12,286	1,302	7.2	4.5	5.2	6.7	23.0	7.8	4.7	6.5	6.3
7	Iron and steel, blast furnaces.	4	9.27	9.27	......	......	14,969	1,614	14,969	1,614	4.8	2.4	4.8	4.5	4.6	20.0	19.4	14.4	10.7
8	Lumber and timber products.	221	6.55	6.58	......	2.62	23,308	3,558	23,232	3,529	5.4	3.4	10.3	13.4	31.1	21.7	3.4	4.1	2.3
9	Oil, cottonseed and cake	20	6.41	6.41	......	......	6,285	980	6,285	980	4.1	7.1	19.5	16.6	28.2	8.7	5.4	3.9	2.5

CALIFORNIA.

	INDUSTRY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	4,348	$13.24	$14.59	$7.24	$4.12	$992,995	75,024	$901,474	61,766	1.1	0.9	1.3	1.7	2.5	2.6	2.3	5.7	11.3
2	Eleven selected industries.	2,096	13.03	14.64	7.42	3.95	559,029	42,903	495,598	33,850	1.3	0.8	1.2	1.3	2.6	2.3	2.3	5.1	11.4
3	Bread and other bakery products.	489	14.07	15.47	7.49	6.70	30,504	2,168	27,704	1,791	0.1	0.3	0.6	0.9	3.1	3.1	3.0	3.6	10.5
4	Canning and preserving, fruits and vegetables.	51	8.54	11.46	7.33	3.59	98,308	11,509	46,021	4,015	6.1	2.3	2.2	2.3	4.2	4.5	6.9	9.8	14.9
5	Cars and general shop construction and repairs by steam railroad companies.	16	15.48	15.49	......	6.40	107,325	6,932	107,293	6,927	1.0	0.4	0.6	1.2	1.3	1.0	1.8	2.9	10.8
6	Foundry and machine shop products.	238	15.36	15.48	8.56	5.52	81,548	5,309	81,162	5,244	0.3	0.8	1.6	1.9	3.2	2.7	1.4	2.4	6.7
7	Leather, tanned, curried, and finished.	26	13.59	13.59	......	......	11,713	862	11,713	862	0.6	0.6	0.5	1.0	1.0	1.6	0.9	4.9	6.5
8	Liquors, vinous	174	10.37	10.50	7.36	6.00	15,636	1,508	15,181	1,446	0.5	1.0	0.3	0.2	1.9	4.3	3.7	19.1	44.5
9	Lumber and timber products.	124	15.04	15.09	10.58	4.41	104,559	6,954	104,230	6,906	0.2	0.1	0.2	0.2	1.0	0.3	1.3	4.2	10.6
10	Lumber, planing mill products, including sash, doors, and blinds.	145	14.70	14.96	6.00	4.20	39,046	2,656	38,768	2,592	1.5	0.6	1.1	1.6	3.1	3.6	0.8	7.5	9.5
11	Printing and publishing, book and job.	217	13.55	15.46	7.97	4.71	24,253	1,790	21,150	1,368	0.1	1.8	2.8	2.3	3.9	3.1	3.4	4.3	7.6
12	Printing and publishing, newspapers and periodicals.	403	15.70	17.16	8.88	3.84	37,191	2,369	34,278	1,998	1.4	1.2	1.5	1.9	2.8	1.6	1.4	1.6	7.3
13	Tobacco, cigars and cigarettes.	213	10.57	11.55	6.27	3.61	8,946	846	8,098	701	1.4	2.1	6.4	4.9	13.1	7.0	3.0	5.0	7.4

CONNECTICUT.

	INDUSTRY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	1,970	$10.34	$11.57	$6.81	$4.14	$1,050,057	101,589	$886,287	76,579	1.2	1.3	2.5	3.4	5.2	7.1	8.1	13.9	16.9
2	Fifteen selected industries.	303	10.12	11.44	7.01	4.26	618,904	61,167	502,534	43,912	1.2	1.3	2.3	3.6	5.8	7.6	8.2	15.2	16.9
3	Brass and copper, rolled	11	11.73	11.99	6.24	5.16	97,702	8,331	95,415	7,959	1.3	0.7	1.5	1.4	2.8	4.6	6.7	25.3	21.1
4	Brassware	14	10.78	12.33	6.83	3.84	54,169	5,024	45,345	3,678	1.3	1.0	1.9	2.7	4.7	5.3	5.9	16.0	16.7
5	Boots and shoes, rubber	5	10.59	12.48	8.42	5.13	56,035	5,292	36,712	2,942	0.6	0.5	1.1	1.4	2.7	4.1	6.7	16.8	19.5
6	Clocks	5	11.31	13.65	7.73	4.27	40,034	3,540	30,804	2,257	0.2	0.4	0.6	1.7	3.6	4.7	5.8	8.9	13.5
7	Corsets	5	7.31	13.88	6.85	3.00	11,082	1,516	1,804	130	......	0.7	......	2.3	0.8	3.1	5.4	13.8	16.9
8	Cotton goods	20	7.36	8.26	6.71	4.02	55,201	7,499	33,233	4,023	1.9	2.4	4.7	11.6	14.3	13.8	12.6	12.4	14.7
9	Cutlery and edge tools	15	11.05	11.84	6.01	5.02	21,476	1,944	19,978	1,687	1.5	0.6	2.2	4.8	3.9	6.6	10.0	7.4	16.7
10	Foundry and machine shop products.	120	11.28	11.45	5.96	4.15	80,983	7,181	79,841	6,973	1.7	1.5	2.7	3.7	4.7	6.6	8.3	12.3	14.5
11	Hardware	34	9.61	10.56	5.13	4.36	83,612	8,697	76,117	7,205	1.0	2.0	3.4	3.9	8.0	11.4	10.1	12.2	17.1
12	Hats, felt	22	11.59	13.74	7.55	......	16,442	1,419	12,712	925	0.1	1.4	2.2	2.3	6.0	9.2	8.1	7.8	11.1
13	Hosiery and knit goods	8	8.22	10.65	6.99	3.81	11,175	1,360	5,100	479	......	0.4	1.5	4.4	14.2	10.4	8.3	15.9	14.8
14	Plated ware	10	13.48	14.63	6.20	4.20	17,870	1,326	16,892	1,155	0.4	0.5	1.5	1.6	3.6	2.5	5.5	5.8	12.7
15	Rubber and elastic goods	14	9.30	11.02	6.82	4.74	24,366	2,620	17,196	1,560	0.6	1.5	2.5	4.2	5.2	7.3	10.5	13.4	18.8
16	Silk and silk goods	6	9.22	11.34	7.37	4.64	33,135	3,592	20,170	1,778	0.4	0.5	1.0	0.8	2.5	4.8	2.1	25.7	16.0
17	Woolen goods	14	8.56	9.66	7.05	4.06	15,622	1,826	11,215	1,161	1.9	1.3	3.0	4.3	12.1	17.9	12.5	10.9	19.3

[1] Less than one-tenth of 1 per cent.

DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905.

MEN 16 YEARS AND OVER—continued. Per cent distribution of number by earnings—Continued. $12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	WOMEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	CHILDREN UNDER 16 YEARS. Earnings.	Number.	Percent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
ALABAMA.																										
6.9	7.1	1.9	0.7	$8,809	1,973	13.2	32.6	24.6	15.3	8.8	3.8	0.9	0.4	0.4	....	(1)	$5,013	1,759	65.6	23.9	7.8	2.3	0.3	....	0.1	1
6.9	6.9	1.7	0.7	7,730	1,747	12.5	34.2	25.4	14.9	8.4	3.7	0.4	0.4	0.1	....	....	4,640	1,632	66.3	23.8	7.6	2.1	0.2	....	....	2
13.0	16.0	2.9	1.1	23	7	....	100.0	....	....	....	....	....	....	....	....	....	27	4	....	....	....	75.0	25.0	....	....	3
5.8	3.4	1.7	0.3	....	....	....	....	....	....	....	....	....	....	....	....	....	[illegible]	25	16.0	64.0	20.0	....	....	....	....	4
1.6	0.9	0.4	0.4	7,707	1,740	12.6	34.0	25.5	14.9	8.5	3.7	0.4	0.3	0.1	....	....	4,445	1,571	66.8	23.6	7.4	2.0	0.2	....	....	5
8.7	13.2	4.3	1.9	....	....	....	....	....	....	....	....	....	....	....	....	....	7	3	66.7	....	33.3	....	....	....	....	6
8.4	3.4	1.7	0.9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7
2.8	1.4	0.5	0.2	....	....	....	....	....	....	....	....	....	....	....	....	....	76	29	89.7	6.9	3.4	....	....	....	....	8
2.3	0.9	0.8	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9
CALIFORNIA.																										
24.5	27.6	14.0	4.5	$85,551	11,809	6.9	7.3	9.1	10.7	14.0	15.4	7.6	9.2	10.3	6.0	3.5	$5,970	1,449	30.8	17.8	18.1	10.1	13.5	3.6	6.1	1
25.7	27.2	14.2	4.6	59,211	7,985	8.4	7.5	8.7	8.5	11.7	15.6	7.3	9.6	11.1	7.2	4.4	4,220	1,068	36.8	16.5	15.3	9.1	12.6	3.4	6.3	2
15.6	37.7	18.1	3.4	2,599	347	0.9	1.1	3.4	8.3	31.7	20.8	5.8	14.4	9.8	3.2	0.6	201	30	13.3	6.7	3.3	16.7	20.0	6.7	33.3	3
28.6	15.0	2.3	0.9	49,743	6,785	9.7	7.9	8.8	7.8	10.3	15.8	7.3	9.7	11.3	7.1	4.3	2,544	709	49.5	11.1	11.0	7.6	12.7	3.0	5.1	4
27.4	28.8	18.2	4.6	....	....	....	....	....	....	....	....	....	....	....	....	....	32	5	....	....	....	....	100.0	....	....	5
21.4	29.2	24.3	4.1	77	[illegible]	....	....	....	22.2	11.1	22.2	11.1	....	22.3	....	11.1	309	56	3.6	17.9	21.4	17.9	14.3	7.1	17.8	6
54.8	23.6	3.0	1.0	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7
20.4	3.7	0.3	0.1	449	61	6.6	18.0	4.9	11.5	8.2	9.8	9.8	8.2	8.2	14.8	....	[illegible]	1	....	....	....	....	100.0	....	....	8
34.5	35.3	7.3	4.8	201	19	....	5.3	....	....	10.5	21.0	....	....	15.8	31.6	15.8	128	29	20.7	27.6	31.0	6.9	13.8	....	....	9
20.2	23.6	23.2	3.7	30	5	....	....	....	....	100.0	....	....	....	....	....	....	248	59	....	44.1	47.4	1.7	....	3.4	3.4	10
14.9	28.9	19.2	7.7	2,726	342	0.6	3.8	12.0	19.9	12.3	10.2	8.2	8.5	9.3	7.6	7.6	377	80	8.8	18.8	31.2	17.5	11.2	5.0	7.5	11
12.1	27.1	20.9	19.2	2,621	295	3.1	7.1	5.1	7.1	12.5	12.5	8.8	7.8	12.6	13.2	10.2	292	76	26.3	26.3	14.5	11.8	14.5	2.6	4.0	12
17.1	24.0	7.4	1.2	765	122	0.8	6.6	18.0	14.8	30.3	9.8	8.2	2.5	5.7	1.7	1.6	[illegible]	23	13.0	69.6	....	8.7	4.4	4.3	....	13
CONNECTICUT.																										
19.1	16.4	3.5	1.4	$153,683	22,575	3.9	6.3	10.6	14.8	18.9	16.6	11.8	8.5	6.2	2.1	0.3	$10,087	2,435	14.5	31.2	29.4	14.1	7.3	2.7	0.8	1
18.3	15.2	3.0	1.4	109,174	15,565	3.6	6.1	9.1	13.7	17.6	17.8	13.0	9.3	7.2	2.3	0.3	7,196	1,690	12.4	29.9	31.1	15.2	7.8	2.8	0.8	2
17.3	10.9	3.9	2.5	2,127	341	5.9	6.1	9.1	16.1	29.9	15.5	10.6	4.7	1.5	0.6	....	160	31	3.2	6.5	54.8	12.9	12.9	6.5	3.2	3
18.7	17.9	4.5	3.4	8,344	1,221	5.3	5.6	8.3	14.2	20.9	19.3	14.1	7.9	3.9	0.4	0.1	480	125	13.6	38.4	39.2	7.2	1.6	....	....	4
22.5	19.7	3.4	1.0	18,590	2,207	2.1	1.9	7.0	10.0	9.9	15.9	11.6	12.6	20.6	7.7	0.7	733	143	11.9	11.2	32.1	16.1	11.9	15.4	1.4	5
23.3	32.9	3.7	0.7	8,385	1,085	0.1	0.1	2.9	12.0	13.9	24.4	29.2	12.6	4.4	0.3	0.1	845	198	6.6	37.9	40.4	11.6	3.5	....	....	6
18.5	20.8	14.6	3.1	9,110	1,330	9.4	7.4	9.3	12.0	14.8	11.5	9.6	11.0	9.3	5.2	0.5	168	56	23.2	66.1	10.7	....	....	....	....	7
8.1	3.0	0.4	0.1	19,957	2,976	3.1	4.4	8.9	16.1	21.7	22.4	12.2	6.4	4.4	0.4	....	2,011	500	17.2	30.0	26.2	17.4	7.2	1.8	0.2	8
22.0	19.8	4.0	0.5	1,262	210	7.1	9.1	9.5	24.8	19.5	17.6	8.6	1.9	0.5	1.4	....	236	47	8.5	29.8	8.5	25.5	12.8	4.3	10.6	9
20.8	20.1	2.4	0.7	918	154	4.5	5.2	7.8	22.7	39.0	7.2	3.9	4.5	5.2	....	....	224	54	5.6	42.6	25.9	22.2	1.8	1.9	....	10
18.0	10.6	1.9	0.4	6,623	1,292	4.6	24.0	24.0	19.6	12.8	8.8	3.8	1.5	0.4	0.5	....	872	200	10.0	30.0	29.5	19.5	8.0	2.0	1.0	11
15.4	16.9	11.1	8.4	3,730	494	3.2	10.7	4.7	11.9	16.8	13.0	10.1	10.3	12.0	5.9	1.4	....	....	....	....	....	....	....	....	....	12
15.0	9.0	4.4	1.7	5,972	854	2.1	4.6	8.8	17.9	20.4	14.2	10.6	9.7	9.9	1.8	....	103	27	7.4	40.7	48.2	3.7	....	....	....	13
20.5	33.7	9.8	1.9	806	130	2.3	10.8	13.1	19.2	33.8	6.2	5.4	2.3	5.4	....	1.5	172	41	4.9	31.7	36.6	24.4	2.4	....	....	14
16.0	17.8	2.0	0.2	7,042	1,033	4.0	6.6	10.6	14.6	17.5	16.0	11.2	9.6	8.2	1.4	0.3	128	27	7.4	29.7	18.5	18.5	18.5	3.7	3.7	15
28.9	15.0	1.2	1.1	12,283	1,667	2.3	2.8	3.3	7.5	18.3	26.3	21.8	16.2	0.7	0.6	0.2	[illegible]	147	14.3	13.6	31.3	15.6	20.4	4.8	....	16
10.3	5.0	1.1	0.4	4,025	571	2.8	4.5	14.2	10.7	20.3	15.2	10.2	10.2	8.6	2.6	0.7	382	94	9.6	29.8	43.6	8.5	7.4	....	1.1	17

TABLE 72.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE STATES, BY SELECTED INDUSTRIES—PER CENT AVERAGE WEEKLY EARNINGS, AND NUMBER OF ALL WAGE-EARNERS AND

GEORGIA.

	INDUSTRY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	1,520	$6.10	$6.70	$4.24	$2.59	$286,187	46,932	$254,571	37,995	8.3	7.5	15.1	19.1	18.3	8.6	5.1	4.2	3.9
2	Ten selected industries.	719	5.85	6.43	4.18	2.62	209,235	35,795	184,899	28,748	7.9	7.5	15.3	21.6	19.2	8.6	4.8	4.0	3.1
3	Cars and general shop construction and repairs by steam railroad companies.	13	10.36	10.39	3.80	......	23,006	2,221	22,968	2,211	1.5	1.0	6.8	3.7	20.8	9.5	8.9	7.6	6.6
4	Cotton goods	43	4.56	5.82	4.17	2.62	54,354	11,932	32,244	5,537	13.1	10.4	19.0	16.7	14.1	8.2	4.7	5.5	3.0
5	Fertilizers	20	5.75	5.75	......	......	18,357	3,193	18,357	3,193	11.6	5.2	7.5	29.6	26.8	7.9	4.0	2.4	2.4
6	Foundry and machine shop products.	42	9.55	9.62	......	3.00	14,357	1,504	14,306	1,487	5.0	7.7	7.1	8.5	13.0	12.1	4.1	5.7	6.7
7	Furniture	15	6.44	7.14	1.30	2.64	5,213	809	4,947	693	9.7	8.6	11.8	11.1	15.6	8.4	5.8	8.2	7.4
8	Hosiery and knit goods	5	4.52	6.27	4.66	2.59	2,458	544	846	135	2.2	4.4	19.3	20.0	18.5	19.3	10.4	3.0	0.8
9	Lumber and timber products.	330	6.02	6.05	......	2.72	47,270	7,848	47,107	7,788	7.1	6.5	16.5	16.8	27.6	11.7	5.1	3.5	2.1
10	Lumber, planing mill products, including sash, doors, and blinds.	66	7.01	7.10	......	2.31	11,558	1,648	11,491	1,619	7.7	7.2	15.8	15.1	19.6	6.8	3.2	4.9	4.5
11	Oil, cottonseed and cake.	49	5.29	5.29	......	......	10,663	2,014	10,663	2,014	13.0	14.8	25.8	17.8	11.4	7.8	2.5	2.5	1.2
12	Turpentine and rosin	136	5.39	5.40	3.00	2.60	21,999	4,082	21,970	4,071	1.1	7.4	16.5	51.9	10.1	2.6	4.7	1.0	2.2

ILLINOIS.

	INDUSTRY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	8,382	$11.55	$12.37	$6.54	$3.58	$2,595,822	224,664	$2,408,866	194,782	1.5	1.2	1.9	2.5	3.6	4.7	6.3	12.1	19.0
2	Twenty selected industries.	4,843	12.14	12.72	6.59	3.79	1,659,468	136,671	1,582,999	124,465	1.4	1.1	1.6	2.1	3.2	4.3	6.1	12.1	19.3
3	Agricultural implements.	44	11.82	11.86	5.20	4.50	97,784	8,276	97,485	8,218	1.3	0.8	1.5	2.1	3.2	4.5	8.6	18.4	15.1
4	Bread and other bakery products.	1,039	10.46	12.36	6.42	4.43	62,247	5,952	50,423	4,081	1.1	1.5	1.7	3.3	4.1	3.7	4.9	8.0	12.6
5	Brick and tile	209	12.13	12.26	4.00	4.51	51,323	4,231	51,003	4,160	2.0	1.3	1.4	1.9	4.0	6.1	6.5	17.6	19.2
6	Cars and general shop construction and repairs by steam railroad companies.	70	12.79	12.80	7.83	4.67	205,878	16,097	205,568	16,055	0.6	0.4	0.9	1.1	1.2	3.9	6.7	12.0	26.2
7	Cars, steam railroad, not including operations of railroad companies.	9	13.13	13.17	7.61	......	163,964	12,483	163,386	12,407	3.6	1.4	1.5	2.1	2.5	4.0	4.9	13.6	14.3
8	Clothing, men's	177	9.27	13.33	6.73	3.34	43,914	4,739	25,447	1,909	0.1	0.5	1.5	2.7	5.1	4.8	5.4	5.3	14.1
9	Clothing, women's	59	10.40	17.90	7.33	3.41	14,417	1,386	7,320	409	0.5	1.0	1.2	0.7	3.2	2.4	3.7	2.9	7.3
10	Electrical machinery, apparatus, and supplies.	48	10.80	11.69	6.80	3.67	16,004	1,482	14,214	1,216	0.7	1.8	1.3	3.3	4.8	5.4	7.2	11.8	18.5
11	Foundry and machine shop products.	424	12.56	12.69	6.11	3.70	302,898	24,122	300,372	23,672	0.9	0.8	1.5	1.9	3.4	3.9	5.6	12.4	20.6
12	Furniture	93	12.35	12.46	5.00	4.16	64,979	5,262	64,646	5,187	0.6	0.7	1.7	2.3	3.4	3.4	4.7	12.5	14.1
13	Glass	3	14.30	17.13	3.86	4.70	12,670	886	11,754	686	......	......	......	9.2	3.9	1.9	13.4	15.3	11.5
14	Iron and steel, steel works and rolling mills.	13	13.29	13.43	5.84	4.64	204,190	15,368	202,490	15,074	1.1	0.7	0.9	1.4	1.7	2.8	6.0	13.2	31.6
15	Liquors, malt	62	14.14	14.37	6.39	5.40	33,803	2,390	33,396	2,324	0.1	0.2	0.9	1.2	2.2	3.9	1.6	5.3	9.3
16	Lumber and timber products.	149	8.09	8.12	7.50	3.55	19,126	2,363	19,072	2,350	3.6	3.1	5.2	3.8	14.7	22.6	17.2	15.0	5.5
17	Lumber, planing mill products, including sash, doors, and blinds.	133	12.90	12.96	7.00	4.50	38,959	3,021	38,841	2,997	0.5	0.5	1.2	1.8	2.5	3.9	3.0	9.8	14.3
18	Musical instruments, pianos.	12	11.85	12.41	5.92	4.01	41,279	3,483	39,944	3,218	(1)	0.5	1.6	4.0	3.4	4.6	7.1	9.5	12.9
19	Printing and publishing, book and job.	497	12.21	14.35	6.58	3.66	101,210	8,288	87,286	6,081	1.6	1.8	4.4	2.7	3.4	3.6	4.4	7.4	9.0
20	Printing and publishing, newspapers and periodicals.	767	11.74	13.37	5.63	2.85	50,783	4,326	46,046	3,444	3.4	3.7	3.0	3.7	4.6	3.8	4.6	6.7	13.8
21	Slaughtering and meat packing, wholesale.	34	10.69	11.00	6.14	3.77	82,597	7,726	80,006	7,276	2.7	1.4	1.6	2.0	4.8	5.8	8.6	13.0	21.9
22	Tobacco, cigars and cigarettes.	1,001	10.74	11.97	7.43	3.00	51,443	4,790	44,300	3,701	1.8	3.9	2.7	2.5	2.7	2.7	3.9	4.9	17.9

[1] Less than one-tenth of 1 per cent.

DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

GEORGIA.

MEN 16 YEARS AND OVER—continued. Per cent distribution of number by earnings—Continued.				WOMEN 16 YEARS AND OVER.													CHILDREN UNDER 16 YEARS.									
				Earnings.	Number.	Per cent distribution of number by earnings.											Earnings.	Number.	Per cent distribution of number by earnings.							
$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
4.4	3.7	1.2	0.6	$21,741	5,129	21.9	23.1	24.2	16.8	8.5	3.0	1.1	0.6	0.5	0.2	0.1	$9,875	3,808	59.5	27.9	10.3	1.9	0.3	0.1	(1)	1
3.8	2.9	1.0	0.3	15,714	3,757	22.0	21.3	26.9	17.4	8.6	2.4	0.8	0.3	0.3	....	....	8,622	3,290	57.8	29.2	10.8	1.9	0.2	0.1	....	2
11.8	15.2	5.8	0.8	38	10	....	100.0	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
2.8	1.9	0.3	0.3	14,390	3,449	22.0	21.9	27.2	17.2	8.2	2.3	0.8	0.2	0.2	....	....	7,720	2,946	57.7	29.0	11.0	2.0	0.2	0.1	....	4
1.4	0.7	0.3	0.2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
10.4	13.7	4.4	1.6	....	....	....	....	....	....	....	....	....	....	....	....	....	51	17	70.6	5.9	23.5	....	....	....	....	6
11.0	1.6	0.4	0.4	39	30	90.0	10.0	....	....	....	....	....	....	....	....	....	227	86	58.2	33.7	8.1	....	....	....	....	7
0.7	0.7	0.7	....	1,244	267	14.6	12.4	27.3	21.7	15.7	4.9	1.1	0.8	1.5	....	....	368	142	54.2	35.2	7.8	2.1	0.7	....	....	8
1.6	0.8	0.4	0.3	....	....	....	....	....	....	....	....	....	....	....	....	....	163	60	60.0	25.0	13.3	1.7	....	....	....	9
9.3	5.1	0.7	0.1	....	....	....	....	....	....	....	....	....	....	....	....	....	67	29	65.5	31.0	3.5	....	....	....	....	10
1.7	0.9	0.4	0.2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	11
2.4	0.1	....	....	3	1	....	100.0	....	....	....	....	....	....	....	....	....	26	10	100.0	....	....	....	....	....	....	12

ILLINOIS.

$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
20.5	19.3	5.2	2.2	$176,645	27,001	5.8	8.7	14.2	15.9	15.9	13.0	8.5	6.5	6.5	3.6	1.4	$10,311	2,881	22.7	38.9	24.3	10.1	3.0	0.8	0.2	1
20.3	20.8	5.4	2.3	71,047	10,776	5.4	8.1	12.3	16.4	16.4	14.5	8.7	6.3	6.4	4.0	1.5	5,422	1,430	18.3	35.7	27.9	13.4	3.2	1.0	0.5	2
21.3	18.3	4.0	0.9	281	54	22.2	14.8	11.1	7.4	14.8	7.4	5.6	14.8	1.9	....	....	18	4	....	50.0	25.0	25.0	....	....	....	3
25.4	31.4	2.0	0.3	11,412	1,778	3.8	5.1	16.0	15.3	20.6	17.0	7.7	5.9	7.1	1.5	(1)	412	93	12.9	22.6	31.1	17.2	5.4	5.4	5.4	4
18.4	12.9	5.0	3.7	4	1	....	....	100.0	....	....	....	....	....	....	....	....	316	70	11.4	14.3	22.9	51.4	....	....	....	5
20.5	18.1	7.5	0.9	282	36	....	....	....	....	5.5	72.2	11.1	5.6	5.6	....	....	28	6	....	16.7	50.0	33.3	....	....	....	6
18.0	24.2	8.7	1.2	578	76	....	15.8	1.3	2.6	6.6	23.7	23.7	15.8	9.2	1.3	....	....	....	....	....	....	....	....	....	....	7
20.2	24.2	13.5	2.6	17,909	2,663	4.8	6.7	8.9	15.1	15.9	15.5	10.6	9.1	8.7	3.9	0.8	558	167	22.8	46.7	25.1	4.2	1.2	....	....	8
17.6	24.5	16.4	18.6	7,039	960	4.4	5.7	8.8	14.8	18.6	13.2	9.3	7.6	9.5	5.8	2.3	58	17	29.4	23.5	35.3	5.9	5.9	....	....	9
24.7	15.4	4.2	0.9	1,768	260	1.5	10.4	8.1	16.9	14.6	17.7	9.2	13.1	7.3	1.2	....	22	6	33.3	33.3	16.7	....	16.7	....	....	10
19.2	24.3	4.2	1.3	2,182	357	3.6	9.8	6.4	26.6	26.3	14.3	7.6	3.1	1.7	0.6	....	344	93	24.7	46.3	11.8	7.5	5.4	3.2	1.1	11
30.8	23.9	1.5	0.4	125	25	8.0	24.0	32.0	24.0	4.0	4.0	....	....	....	....	4.0	208	50	2.0	50.0	24.0	14.0	10.0	....	....	12
5.5	3.7	0.6	35.0	108	28	25.0	28.6	....	46.4	....	....	....	....	....	....	....	808	172	1.8	2.9	67.4	27.9	....	....	....	13
18.1	13.8	3.6	5.1	1,635	280	7.9	8.9	12.8	20.0	23.9	14.3	6.1	2.5	1.8	1.8	....	65	14	....	21.4	42.9	28.6	7.1	....	....	14
29.3	35.2	9.2	1.6	326	51	....	1.9	....	5.9	31.4	41.2	19.6	....	....	....	....	81	15	....	20.0	33.3	....	20.0	26.7	....	15
4.8	3.3	0.9	0.3	15	2	....	....	....	....	....	100.0	....	....	....	....	....	39	11	27.3	27.3	45.4	....	....	....	....	16
27.0	31.8	3.3	0.4	28	4	....	25.0	....	25.0	....	....	25.0	....	25.0	....	....	90	20	....	20.0	55.0	15.0	10.0	....	....	17
26.9	23.8	3.7	2.0	846	143	....	4.2	18.9	27.2	18.9	16.8	4.9	3.5	4.2	1.4	....	489	122	1.7	50.8	21.3	21.3	4.9	....	....	18
12.7	29.5	13.5	6.0	13,185	2,005	5.4	9.9	13.1	14.5	13.9	14.5	10.6	5.4	4.6	6.1	2.0	739	202	16.3	41.6	32.7	7.4	2.0	....	....	19
16.6	17.6	8.2	10.3	4,503	800	11.4	16.4	17.8	18.1	11.7	6.0	5.2	4.1	4.1	3.8	1.4	234	82	46.3	31.7	9.8	8.5	3.7	....	....	20
22.9	12.4	2.1	0.8	2,316	377	4.2	3.4	25.2	36.6	13.0	7.7	3.2	1.3	0.8	2.7	1.9	275	73	8.2	61.6	19.2	4.1	5.5	....	1.4	21
27.9	25.2	3.5	0.4	6,505	876	8.0	8.3	11.4	12.4	13.5	13.4	5.9	4.5	7.2	8.0	7.4	638	213	40.8	42.2	9.9	3.8	1.9	1.4	....	22

Table 72.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE STATES, BY SELECTED INDUSTRIES—PER CENT AVERAGE WEEKLY EARNINGS, AND NUMBER OF ALL WAGE-EARNERS AND

INDIANA.

	INDUSTRY.	Number of establishments.	AVERAGE WEEKLY EARNINGS.				TOTAL.		MEN 16 YEARS AND OVER.										
			All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Earnings.	Number.	Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	4,678	$10.10	$10.88	$4.83	$3.75	$1,257,958	124,607	$1,184,102	108,854	2.3	1.9	2.8	3.5	5.4	8.5	10.2	17.0	14.9
2	Ten selected industries.	1,734	10.80	11.09	4.47	4.10	676,280	62,603	664,616	59,920	2.0	1.6	2.7	3.6	5.5	9.3	10.9	16.4	14.4
3	Agricultural implements	25	11.04	11.07	3.33	2.80	24,284	2,200	24,260	2,192	0.7	1.3	3.5	3.9	5.2	10.3	15.0	12.1	14.2
4	Brick and tile	243	9.40	9.50	......	3.59	31,984	3,403	31,765	3,342	1.1	1.1	1.1	1.7	4.8	13.4	14.5	27.8	17.6
5	Carriages and wagons	139	9.59	9.80	5.65	4.34	70,311	7,334	68,510	6,994	3.8	1.0	2.2	2.1	4.8	7.8	7.6	29.4	17.2
6	Cars and general shop construction and repairs by steam railroad companies.	36	12.34	12.34	7.33	......	134,432	10,897	134,322	10,882	0.3	0.5	1.2	1.5	2.5	5.8	13.0	12.7	18.3
7	Foundry and machine shop products.	206	10.60	10.76	4.24	3.21	101,316	9,561	100,338	9,321	2.0	2.1	3.4	3.8	4.5	8.2	9.7	14.8	15.6
8	Furniture	98	8.96	9.39	3.58	3.44	54,635	6,095	53,079	5,655	1.1	2.7	3.8	4.9	8.0	13.1	13.7	13.9	16.6
9	Glass	42	11.49	12.24	3.72	4.68	86,509	7,531	83,407	6,812	4.3	3.1	4.7	10.9	8.1	5.6	6.1	8.4	9.1
10	Iron and steel, steel works and rolling mills.	15	13.32	13.38	4.60	4.00	105,868	7,949	105,626	7,896	1.3	1.0	2.4	1.1	3.0	8.1	13.2	12.7	11.2
11	Lumber and timber products.	501	8.62	8.65	5.93	3.89	44,119	5,119	43,927	5,077	2.2	1.9	2.4	3.3	11.9	22.1	10.1	25.7	7.5
12	Printing and publishing, newspapers and periodicals.	429	9.08	11.08	4.69	2.43	22,822	2,514	19,382	1,749	4.4	3.4	3.5	3.9	8.2	6.0	6.2	9.7	12.9

KENTUCKY.

	INDUSTRY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	2,251	$8.38	$9.20	$4.94	$2.81	$298,109	35,590	$269,836	29,333	3.9	4.1	5.5	6.0	14.0	13.6	7.6	10.5	11.0
2	Ten selected industries.	1,133	8.36	8.96	5.13	2.56	164,488	19,674	151,195	16,874	3.5	3.8	5.6	5.7	17.4	15.2	6.8	11.1	9.3
3	Carriages and wagons	70	9.11	9.31	4.62	3.53	13,211	1,450	13,010	1,398	1.6	2.4	4.8	6.5	8.7	23.6	10.6	8.4	11.2
4	Cars and general shop construction and repairs by steam railroad companies.	15	10.64	10.64	7.67	......	28,255	2,656	28,209	2,650	0.8	0.8	1.7	0.9	4.7	8.4	7.3	14.5	21.5
5	Clothing, men's	54	6.06	9.92	5.14	2.55	13,627	2,248	4,661	470	3.0	5.3	4.4	6.6	11.1	10.0	11.1	9.1	10.4
6	Flour and grist mill products.	301	7.03	7.06	3.00	2.14	7,609	1,083	7,591	1,075	2.5	5.4	9.7	8.4	36.5	11.9	4.0	7.9	3.4
7	Foundry and machine shop products.	41	10.23	10.31	4.00	3.50	10,589	1,035	10,544	1,023	4.5	3.1	4.1	3.3	6.5	11.4	8.1	12.6	11.3
8	Iron and steel, steel works and rolling mills.	4	14.16	14.16	......	......	20,575	1,453	20,575	1,453	3.4	2.2	1.6	3.8	4.4	7.7	5.4	17.8	9.5
9	Liquors, distilled	121	9.12	9.32	4.20	3.33	12,479	1,369	12,259	1,316	1.4	2.0	2.7	3.2	21.8	15.7	4.8	17.5	7.2
10	Lumber and timber products.	424	6.84	6.91	3.40	2.85	31,876	4,660	31,648	4,581	4.6	4.6	9.6	8.3	28.6	20.8	6.5	7.9	3.0
11	Lumber, planing mill products, including sash, doors, and blinds.	64	8.91	8.97	......	3.75	11,989	1,346	11,929	1,330	3.5	2.6	4.6	6.8	16.4	12.3	5.8	10.7	9.8
12	Tobacco, chewing and smoking, and snuff.	39	6.01	6.82	5.19	2.17	14,278	2,374	10,769	1,578	8.4	10.5	7.2	8.0	18.3	17.7	7.5	7.4	8.6

LOUISIANA.

	INDUSTRY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	748	$9.16	$9.93	$4.52	$3.23	$156,038	17,043	$146,193	14,723	4.0	3.4	3.4	3.4	7.1	11.8	10.0	15.6	14.8
2	Five selected industries.	105	9.34	9.86	4.52	4.14	106,227	11,372	101,351	10,279	4.5	2.9	3.2	2.8	6.5	12.9	11.3	15.9	15.9
3	Cars and general shop construction and repairs by steam railroad companies.	7	10.78	10.78	......	......	20,650	1,916	20,650	1,916	5.1	2.5	3.1	3.1	3.2	8.9	14.3	10.3	18.2
4	Lumber and timber products.	64	9.63	9.67	......	5.14	57,448	5,964	57,227	5,921	3.8	3.4	3.0	2.5	6.7	13.8	11.6	20.0	14.2
5	Oil, cottonseed and cake	8	7.14	7.14	......	......	5,861	821	5,861	821	13.5	4.4	3.8	4.1	22.2	20.7	6.8	9.6	4.3
6	Sugar and molasses, refining.	16	11.23	11.27	5.75	3.00	16,167	1,439	16,135	1,432	0.3	0.5	2.6	1.7	1.3	9.8	8.9	10.7	27.2
7	Tobacco, cigars and cigarettes.	10	4.95	7.82	4.52	3.84	6,101	1,232	1,478	189	14.3	5.8	10.1	9.5	6.3	12.2	10.1	11.6	9.5

DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

INDIANA.

MEN 16 YEARS AND OVER—continued. Per cent distribution of number by earnings—Continued. $12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	WOMEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	CHILDREN UNDER 16 YEARS. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
15.7	12.1	3.6	2.1	$65,966	13,650	14.9	19.8	21.0	15.5	14.2	7.2	3.7	1.6	1.3	0.5	0.3	$7,890	2,103	31.0	28.4	20.5	9.5	6.7	1.8	2.1	1
14.8	11.7	4.1	3.0	8,064	1,805	18.8	24.6	22.5	14.8	10.2	3.7	2.3	1.0	1.2	0.3	0.6	3,600	878	25.6	22.8	23.9	10.6	10.5	2.6	4.0	2
17.2	12.8	2.6	1.2	10	3	66.7	.....	.....	33.3	.....	.....	.....	.....	.....	.....	.....	14	5	100.0	.....	.....	.....	.....	.....	.....	3
12.9	3.3	0.6	0.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	219	61	23.0	44.3	22.9	8.2	.....	.....	1.6	4
15.6	7.0	1.3	0.2	1,406	249	7.2	15.7	14.1	17.7	18.5	14.0	8.0	2.0	2.4	.....	0.4	395	91	6.6	20.9	36.2	30.8	3.3	1.1	1.1	5
18.0	19.7	4.7	1.8	110	15	.....	.....	.....	.....	80.0	.....	13.3	6.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6
17.2	15.8	2.3	0.6	856	202	5.4	38.6	33.7	14.8	4.0	2.0	.....	0.5	1.0	.....	.....	122	38	39.5	34.2	26.3	.....	.....	.....	.....	7
15.8	5.5	0.6	0.3	1,075	300	28.7	24.3	11.3	14.0	9.7	1.0	0.7	.....	0.3	.....	.....	481	140	34.3	30.7	27.9	7.1	.....	.....	.....	8
10.9	9.1	9.0	10.7	1,012	272	29.0	34.5	18.0	11.8	4.4	1.5	0.4	0.4	.....	.....	.....	2,090	447	21.5	15.4	20.6	10.7	19.5	4.9	7.4	9
13.5	14.6	8.9	9.0	230	50	60.0	10.0	12.0	14.0	.....	.....	.....	4.0	.....	.....	.....	12	3	.....	100.0	.....	.....	.....	.....	.....	10
7.4	4.1	1.1	0.3	83	14	.....	.....	7.2	.....	85.7	7.1	.....	.....	.....	.....	.....	109	28	14.3	35.7	46.4	.....	3.6	.....	.....	11
17.2	13.2	10.1	1.3	3,282	700	12.0	22.3	30.4	15.9	9.3	2.7	2.3	1.3	1.7	0.7	1.4	158	65	56.9	24.6	13.9	3.1	1.5	.....	.....	12

KENTUCKY.

$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
11.3	8.3	2.2	2.0	$24,780	5,015	14.3	20.5	18.5	15.1	13.3	7.7	4.0	3.4	2.4	0.6	0.2	$3,493	1,242	55.6	30.3	10.1	2.6	1.0	0.2	0.2	1
9.5	7.3	2.1	2.7	12,229	2,384	14.9	16.4	18.3	17.4	12.1	8.5	4.2	4.3	2.6	1.0	0.3	1,064	416	70.2	16.6	11.3	1.9	.....	.....	.....	2
13.7	6.9	0.8	0.8	74	16	.....	18.8	31.2	50.0	.....	.....	.....	.....	.....	.....	.....	127	36	38.9	8.3	38.9	13.9	.....	.....	.....	3
12.3	19.6	7.0	0.5	46	6	.....	.....	.....	.....	.....	66.7	16.7	16.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
13.0	7.9	5.1	3.0	8,790	1,709	13.4	13.9	19.7	19.2	13.0	10.0	4.2	4.7	1.2	0.3	0.4	176	69	66.7	31.9	.....	1.4	.....	.....	.....	5
5.9	3.8	0.5	0.1	3	1	100.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15	7	85.7	14.3	.....	.....	.....	.....	.....	6
13.5	16.8	4.7	0.1	24	6	.....	33.4	33.3	33.3	.....	.....	.....	.....	.....	.....	.....	21	6	16.7	50.0	16.7	16.6	.....	.....	.....	7
13.4	3.3	2.1	25.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8
10.9	10.1	1.4	1.3	210	50	.....	28.0	48.0	18.0	.....	2.0	2.0	2.0	.....	.....	.....	10	3	.....	66.7	33.3	.....	.....	.....	.....	9
3.4	1.5	0.7	0.5	17	5	40.0	20.0	40.0	.....	.....	.....	.....	.....	.....	.....	.....	211	74	48.6	31.1	18.9	1.4	.....	.....	.....	10
20.5	6.7	0.2	0.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	60	16	6.2	12.5	81.3	.....	.....	.....	.....	11
4.2	1.8	0.1	0.3	3,065	591	20.6	22.7	11.3	11.7	11.2	4.4	4.2	3.4	7.3	3.2	.....	444	205	91.7	6.3	2.0	.....	.....	.....	.....	13

LOUISIANA.

$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
13.7	9.6	2.0	1.2	$8,244	1,824	19.4	19.1	19.9	19.3	12.2	7.0	2.1	0.5	0.2	0.2	0.1	$1,601	496	47.0	24.0	14.7	7.3	2.4	1.4	3.2	1
13.0	8.0	2.0	1.1	4,139	915	22.9	16.6	17.7	17.2	14.1	7.3	3.0	0.8	0.3	0.1	.....	737	178	21.4	26.4	25.3	14.0	3.4	3.9	5.6	2
15.1	10.5	3.8	1.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3
11.6	7.0	1.3	1.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	321	43	.....	16.3	48.8	11.6	2.3	16.3	4.7	4
5.0	5.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5
21.3	11.4	3.3	1.0	23	4	.....	.....	25.0	.....	75.0	.....	.....	.....	.....	.....	.....	9	3	.....	100.0	.....	.....	.....	.....	.....	6
7.4	.....	1.6	1.6	4,116	911	22.9	16.7	17.7	17.3	13.8	7.4	3.0	0.8	0.3	0.1	.....	507	132	28.8	28.0	18.2	15.1	3.8	.....	6.1	7

TABLE 72.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE STATES, BY SELECTED INDUSTRIES—PER CENT AVERAGE WEEKLY EARNINGS, AND NUMBER OF ALL WAGE-EARNERS, AND

	INDUSTRY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
	MAINE.																		
1	All industries	1,711	$9.39	$10.23	$6.84	$4.20	$406,537	43,277	$342,291	33,448	1.5	1.4	1.9	2.6	6.9	9.1	8.9	22.6	16.9
2	Ten selected industries.	695	9.32	10.15	7.21	4.19	292,320	31,363	238,191	23,463	1.4	1.5	2.0	2.7	7.6	9.3	9.2	23.2	16.6
3	Boots and shoes	22	10.25	11.24	7.85	2.00	19,590	1,911	15,246	1,356	2.1	1.4	1.6	3.8	6.3	6.7	9.0	9.1	19.6
4	Canning and preserving, fish.	95	9.99	11.83	8.80	5.07	51,345	5,139	31,365	2,652	2.0	1.1	2.7	3.0	6.2	6.2	7.4	16.0	13.6
5	Cotton goods	7	6.88	8.16	6.15	2.49	32,080	4,666	16,544	2,028	2.3	5.7	5.0	6.7	14.8	13.0	11.0	12.0	17.4
6	Foundry and machine shop products.	46	10.21	10.21	......	......	18,825	1,843	18,825	1,843	0.1	2.8	3.3	4.1	8.4	14.2	9.3	12.8	13.3
7	Lumber and timber products.	388	9.30	9.31	6.00	4.27	82,230	8,842	82,130	8,821	0.7	0.5	0.7	1.1	8.4	9.8	10.8	36.8	17.3
8	Marble and stone work	23	13.93	13.95	......	5.00	14,777	1,061	14,762	1,058	0.2	0.1	......	0.2	0.9	2.8	2.2	15.9	10.6
9	Paper and wood pulp	16	11.24	11.38	6.11	5.00	32,954	2,931	32,504	2,857	2.6	1.1	1.6	1.6	2.2	3.3	6.4	19.5	20.6
10	Printing and publishing, newspapers and periodicals.	65	8.04	11.22	5.84	4.22	6,718	836	3,860	344	1.4	3.2	4.1	7.0	10.2	6.4	6.1	7.8	9.9
11	Woolen goods	29	8.39	9.13	7.00	4.19	21,608	2,576	15,639	1,713	3.5	1.2	3.0	3.7	8.2	14.6	12.8	19.8	17.6
12	Worsted goods	4	7.83	9.25	7.30	3.47	12,193	1,558	7,316	791	1.1	2.4	4.0	7.1	10.5	17.6	7.6	8.9	13.4
	MARYLAND.																		
1	All industries	2,283	$8.60	$10.27	$4.99	$2.87	$564,123	65,601	$473,295	46,082	3.9	4.3	5.1	4.8	7.9	10.2	9.1	10.6	13.4
2	Eleven selected industries.	505	8.35	10.72	4.99	2.78	267,553	32,036	209,087	19,496	4.0	3.8	4.7	3.8	6.9	8.9	9.4	9.7	14.3
3	Canning and preserving, fruits and vegetables.	29	5.37	7.84	4.63	3.08	24,796	4,615	10,971	1,400	8.6	8.3	5.6	3.6	12.8	14.9	9.3	13.4	10.6
4	Cars and general shop construction and repairs by steam railroad companies.	17	12.47	12.48	7.14	......	57,232	4,588	57,182	4,581	0.3	0.3	1.3	1.1	3.9	3.6	11.1	10.2	20.7
5	Clothing, men's	68	8.69	12.15	5.71	3.19	24,447	2,812	16,094	1,325	0.3	2.0	3.8	3.2	3.6	5.4	6.6	7.9	18.6
6	Clothing, women's	31	6.67	13.45	5.11	2.50	9,847	1,477	3,739	278	0.7	0.7	0.7	2.2	3.3	6.5	5.4	10.4	11.9
7	Cotton goods	4	5.44	7.86	5.07	2.62	15,235	2,799	6,968	886	2.4	7.9	13.7	3.6	14.2	17.1	5.2	11.9	12.0
8	Foundry and machine shop products.	78	12.61	12.62	......	3.17	47,386	3,759	47,367	3,753	3.4	2.7	2.8	1.9	3.8	11.1	8.6	9.0	10.9
9	Furniture	30	9.46	9.84	6.80	3.06	12,339	1,305	12,088	1,229	5.5	3.3	6.6	7.1	9.6	9.1	7.8	9.6	12.2
10	Shipbuilding, iron and steel.	3	10.08	10.11	......	5.53	23,845	2,366	23,740	2,347	5.1	4.2	8.0	6.2	9.7	8.4	7.8	6.6	11.0
11	Shirts	13	5.33	8.80	4.70	2.20	25,398	4,761	8,564	973	1.3	6.2	7.0	10.4	10.3	14.2	13.9	9.3	11.1
12	Tinware	25	7.36	7.70	4.25	3.00	13,572	1,845	12,828	1,667	14.8	10.6	7.1	5.1	8.6	8.9	10.2	9.3	12.5
13	Tobacco, cigars and cigarettes.	207	7.87	9.03	6.23	2.91	13,456	1,709	9,546	1,057	4.0	4.1	4.5	6.1	6.0	11.2	12.2	13.1	16.8
	MASSACHUSETTS.																		
1	All industries	8,724	$9.68	$11.15	$6.91	$4.20	$4,713,422	487,048	$3,652,719	327,717	1.0	1.3	2.7	4.2	6.7	8.5	8.7	12.2	15.8
2	Eighteen selected industries.	3,455	9.44	10.87	7.14	4.32	2,955,058	313,066	2,193,638	201,834	1.1	1.4	2.9	4.9	7.9	10.0	9.4	12.1	15.1
3	Boots and shoes	401	11.18	12.79	8.26	4.01	621,169	55,573	469,201	36,690	1.1	1.4	2.4	3.2	5.1	5.6	6.2	8.8	14.6
4	Boots and shoes, rubber	7	9.78	11.06	8.48	3.96	81,330	8,318	50,028	4,524	0.9	1.4	2.7	2.2	4.3	6.3	3.4	20.7	16.8
5	Bread and other bakery products.	900	10.98	12.21	6.20	3.61	58,776	5,352	52,592	4,306	0.6	1.0	1.2	2.1	4.3	4.8	6.1	8.1	15.4
6	Carpets and rugs, other than rag.	9	8.43	10.24	7.16	4.38	40,923	4,856	24,050	2,349	1.8	1.3	5.1	5.9	10.3	11.1	13.4	10.3	14.4
7	Cotton goods	109	7.47	8.53	6.79	4.42	637,975	85,353	352,647	41,320	1.4	1.8	4.4	9.5	16.0	16.6	12.3	10.6	13.1
8	Dyeing and finishing textiles.	40	8.41	9.14	6.36	4.23	63,958	7,604	53,468	5,852	1.0	2.2	2.9	6.2	13.0	26.5	12.6	11.1	10.0
9	Electrical machinery, apparatus, and supplies.	65	10.79	11.75	6.98	4.07	111,703	10,357	98,913	8,418	1.2	1.3	2.2	3.6	4.1	5.9	8.6	9.1	15.3
10	Foundry and machine shop products.	599	11.62	11.73	6.43	4.24	402,536	34,655	398,962	34,012	0.7	1.0	2.1	2.6	4.6	6.0	7.6	14.2	16.4
11	Furniture	110	10.48	11.04	6.88	4.66	72,299	6,899	66,784	6,045	0.5	1.1	1.6	2.5	3.7	8.4	12.0	14.5	18.6
12	Hosiery and knit goods	45	6.98	9.40	6.35	3.98	55,427	7,937	19,345	2,057	0.8	1.1	4.4	8.8	16.4	13.4	12.8	9.5	11.4
13	Jewelry	114	10.62	12.94	7.10	4.03	64,060	6,031	47,876	3,701	0.6	0.8	3.7	4.5	4.7	6.5	7.8	6.5	13.9
14	Leather, tanned, curried, and finished.	119	9.84	9.91	6.23	3.34	99,078	10,064	98,306	9,921	1.2	1.2	2.8	4.4	7.0	9.8	11.3	17.8	22.1
15	Paper and wood pulp	83	9.43	11.24	6.13	5.14	109,151	11,581	84,103	7,480	0.7	0.5	0.8	1.1	3.0	4.8	9.9	28.1	19.4
16	Printing and publishing, book and job.	428	11.22	12.86	7.85	3.61	66,920	5,964	52,766	4,103	1.2	3.1	4.1	3.4	4.6	3.5	4.4	4.9	8.2
17	Printing and publishing, newspapers and periodicals.	239	14.29	16.17	7.86	3.25	75,412	5,279	66,549	4,116	1.3	2.2	3.6	3.2	3.5	2.6	2.3	3.2	7.6
18	Rubber and elastic goods.	43	9.10	10.35	7.50	3.87	46,896	5,153	31,786	3,070	0.1	0.2	2.2	2.8	5.2	6.1	8.5	24.3	22.1
19	Woolen goods	105	8.59	9.40	7.35	4.59	176,139	20,514	125,202	13,318	1.5	1.0	2.3	4.6	9.8	17.7	14.5	12.7	15.9
20	Worsted goods	39	7.94	9.58	6.68	4.38	171,306	21,576	101,060	10,552	2.2	1.7	4.8	8.2	7.6	12.9	11.4	9.3	15.6

1 Less than one-tenth of 1 per cent.

DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

MAINE.

MEN 16 YEARS AND OVER—continued. Per cent distribution of number by earnings—Continued. $12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	WOMEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	CHILDREN UNDER 16 YEARS. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
15.7	10.2	1.7	0.6	$59,440	8,684	3.6	6.6	14.5	16.8	16.5	12.1	9.2	7.6	7.5	3.8	1.8	$4,806	1,145	21.2	27.2	21.5	10.7	10.8	5.4	3.2	1
13.9	10.2	1.9	0.5	50,167	6,955	3.3	5.8	10.7	16.6	15.6	12.6	10.5	8.9	9.1	4.7	2.2	3,962	945	20.8	28.6	19.8	12.1	9.8	5.1	3.8	2
22.5	13.1	3.1	1.7	4,340	553	2.7	5.4	9.9	9.8	15.6	11.0	11.8	10.3	15.6	6.3	1.6	4	2	100.0	.....	.....	.....	.....	.....	.....	3
14.8	17.6	7.6	1.8	17,379	1,974	4.7	5.5	5.4	6.4	10.8	10.0	12.6	13.8	13.9	10.8	6.1	2,601	513	15.0	13.6	20.7	18.1	16.6	9.0	7.0	4
9.8	1.8	0.3	0.2	15,075	2,453	2.1	7.8	13.9	20.8	17.0	16.4	11.2	6.2	4.2	0.4	.....	461	185	41.1	50.3	4.9	2.7	0.5	0.5	.....	5
14.5	16.0	0.9	0.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6
9.8	3.6	0.4	0.1	36	6	.....	.....	16.7	.....	66.7	16.6	.....	.....	.....	.....	.....	64	15	20.0	20.0	13.3	20.0	26.7	.....	.....	7
11.6	54.2	1.2	0.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15	3	.....	.....	66.7	.....	33.3	.....	.....	8
24.0	12.8	3.5	0.8	440	72	.....	.....	.....	18.0	73.6	4.2	4.2	.....	.....	.....	.....	10	2	.....	.....	.....	100.0	.....	.....	.....	9
18.6	18.3	3.5	3.5	2,820	453	3.3	6.4	16.8	42.1	12.4	6.4	2.5	3.5	3.3	0.8	2.5	38	9	11.1	44.5	11.1	11.1	11.1	11.1	.....	10
11.4	3.4	0.7	0.1	5,856	836	4.1	3.7	12.7	15.8	19.7	12.3	8.5	8.4	10.0	4.2	0.6	113	27	3.7	37.0	48.2	7.4	3.7	.....	.....	11
20.6	6.7	0.1	.....	4,221	578	2.8	1.5	9.5	19.9	15.4	14.2	9.2	9.3	11.8	5.2	1.2	656	189	19.6	47.6	28.6	4.2	.....	.....	.....	12

MARYLAND.

13.9	11.3	3.5	2.0	$81,950	16,425	14.8	17.1	20.5	14.7	14.3	9.3	4.5	2.6	1.4	0.6	0.2	$8,878	3,094	60.0	27.0	7.0	4.4	1.2	0.3	0.1	1
15.9	12.4	4.2	2.0	53,291	10,676	14.2	16.5	22.1	13.5	14.6	9.8	4.4	2.8	1.4	0.6	0.1	5,175	1,864	67.1	21.7	5.9	4.9	0.3	0.1	.....	2
6.1	5.6	0.7	0.5	11,713	2,530	18.9	19.9	17.7	3.9	18.9	17.3	1.3	0.7	0.8	0.5	0.1	2,112	685	55.5	22.0	11.5	10.4	0.4	0.2	.....	3
22.8	14.0	9.3	1.4	50	7	.....	14.3	.....	.....	14.3	42.8	28.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
20.5	23.3	3.7	1.1	8,187	1,435	14.3	12.5	14.8	14.5	16.7	7.7	9.4	6.6	2.8	0.6	0.1	166	52	48.1	44.2	5.8	.....	1.9	.....	.....	5
27.7	15.1	8.6	6.8	6,093	1,193	19.8	16.5	14.7	16.2	11.5	7.4	5.3	3.5	2.9	1.6	0.6	15	6	66.6	16.7	16.7	.....	.....	.....	.....	6
7.2	4.6	0.2	.....	6,733	1,328	2.2	9.2	49.1	12.8	13.5	7.0	3.5	2.0	0.7	.....	.....	1,534	585	68.9	28.2	2.7	0.2	.....	.....	.....	7
17.5	17.2	4.5	6.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	19	6	50.0	50.0	.....	.....	.....	.....	.....	8
13.0	12.7	2.4	1.1	34	5	.....	.....	.....	20.0	20.0	40.0	20.0	.....	.....	.....	.....	217	71	53.5	36.6	9.9	.....	.....	.....	.....	9
15.9	13.6	2.9	0.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	105	19	.....	.....	.....	100.0	.....	.....	.....	10
9.8	5.8	0.7	.....	15,988	3,403	14.3	19.0	20.7	19.6	13.0	7.1	3.7	1.9	0.4	0.3	.....	846	385	95.1	4.7	.....	0.2	.....	.....	.....	11
6.6	4.0	1.5	0.8	714	168	20.8	42.8	12.5	8.9	3.6	3.0	2.4	3.0	3.0	.....	.....	30	10	50.0	50.0	.....	.....	.....	.....	.....	12
14.9	6.8	0.3	.....	3,779	607	6.4	5.9	24.9	13.7	13.0	11.2	9.1	8.7	4.0	2.6	0.5	131	45	60.0	28.9	8.9	.....	2.2	.....	.....	13

MASSACHUSETTS.

18.1	15.8	3.5	1.5	$997,840	144,380	3.0	5.4	10.8	16.3	19.6	14.6	11.2	8.4	6.7	3.0	1.0	$62,863	14,951	13.7	31.6	32.1	14.6	5.8	1.4	0.8	1
16.7	13.9	3.2	1.4	711,486	99,671	2.5	3.9	9.6	15.8	20.0	15.4	11.9	9.4	7.4	3.1	1.0	49,934	11,561	12.1	30.1	34.7	14.7	6.1	1.4	0.9	2
21.3	21.7	6.2	2.4	148,219	17,948	3.1	3.8	6.7	9.8	11.8	12.8	11.3	11.8	14.4	10.3	4.2	3,749	935	18.1	30.6	29.1	13.2	7.2	1.2	0.6	3
18.4	19.5	3.1	0.3	30,533	3,600	1.0	1.9	6.9	6.6	10.1	12.4	15.2	29.9	13.6	2.4	.....	769	194	30.4	34.0	18.1	12.9	4.6	.....	.....	4
28.3	24.9	3.0	0.2	5,769	931	5.9	6.3	10.3	15.5	21.4	17.6	11.1	6.2	5.1	0.5	0.1	415	115	27.8	30.4	22.6	12.2	6.1	0.9	.....	5
14.4	9.9	1.4	0.7	15,172	2,119	4.5	3.9	11.4	18.8	17.2	10.0	12.2	8.2	10.8	3.0	.....	1,701	388	17.3	30.9	35.0	15.2	0.8	0.3	0.5	6
9.6	3.5	0.8	0.4	260,139	38,334	2.0	4.0	9.2	17.5	21.8	18.2	13.5	8.7	4.7	0.4	[1]	25,189	5,699	10.7	30.9	34.9	14.5	6.3	1.5	1.2	7
6.8	3.8	1.0	2.9	9,209	1,449	1.5	2.1	17.0	23.7	37.6	6.9	7.0	2.5	1.5	0.1	0.1	1,281	303	4.3	33.0	44.2	17.5	1.0	.....	.....	8
25.9	19.0	3.2	0.6	11,752	1,684	3.2	5.0	9.6	15.9	16.3	19.7	20.1	5.0	4.0	1.2	.....	1,038	255	18.8	22.7	31.4	14.5	6.7	3.5	2.4	9
20.1	20.5	3.3	0.9	2,493	388	1.8	6.4	18.6	20.6	22.9	12.9	5.2	3.9	3.6	2.6	1.5	1,081	255	19.6	29.0	35.7	10.2	3.5	0.8	1.2	10
19.3	15.6	1.7	0.5	4,765	693	0.7	5.1	6.2	21.2	18.5	19.6	13.0	6.9	5.2	3.3	0.3	750	161	11.2	14.9	13.7	47.2	11.2	1.2	0.6	11
11.3	7.1	1.5	1.5	33,986	5,353	2.2	5.2	16.7	16.5	20.6	20.1	11.2	4.5	2.4	0.5	0.1	2,096	527	8.9	59.0	19.6	8.2	3.0	1.1	0.2	12
20.0	19.7	7.6	3.7	15,716	2,214	4.9	3.1	10.2	16.5	16.0	15.3	12.2	8.0	6.9	5.5	1.4	468	116	20.7	33.6	19.0	17.2	7.8	1.7	.....	13
12.9	7.4	1.4	0.7	635	102	2.0	2.9	9.8	17.6	34.3	27.5	3.9	.....	1.0	1.0	.....	137	41	41.5	29.3	19.5	9.7	.....	.....	.....	14
15.4	12.9	2.7	0.7	24,642	4,022	2.0	3.0	12.0	16.3	44.8	12.7	5.5	2.7	0.5	0.3	0.2	406	79	5.0	11.4	26.6	11.4	45.6	.....	.....	15
21.1	31.7	6.6	3.2	13,761	1,752	3.7	7.4	6.7	12.5	12.7	15.4	10.6	6.3	12.5	7.8	4.4	393	109	18.3	41.3	26.6	9.2	3.7	0.9	.....	16
14.2	24.2	16.2	15.9	8,668	1,103	2.1	4.1	9.0	10.4	13.9	13.7	10.8	9.6	11.0	8.8	6.6	195	60	11.7	55.0	23.3	6.6	1.7	.....	1.7	17
15.2	10.6	2.2	0.5	14,560	1,941	1.5	3.8	11.3	14.2	22.1	15.9	10.1	10.3	7.7	2.1	1.0	550	142	20.4	38.8	30.3	4.9	2.8	2.1	0.7	18
13.4	5.0	0.9	0.7	47,630	6,476	1.9	3.5	9.4	15.6	15.5	14.5	12.6	11.3	10.7	4.5	0.5	3,307	720	6.1	25.8	33.3	22.2	9.5	2.0	1.1	19
16.5	8.4	1.1	0.4	63,837	9,562	3.9	2.8	11.9	21.9	24.8	10.4	8.3	7.5	6.3	1.9	0.3	6,409	1,462	9.6	18.5	50.6	14.0	5.4	1.5	0.4	20

TABLE 72.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE STATES, BY SELECTED INDUSTRIES—PER CENT AVERAGE WEEKLY EARNINGS, AND NUMBER OF ALL WAGE-EARNERS AND

	INDUSTRY.	Number of establishments.	Average weekly earnings: All wage-earners.	Average weekly earnings: Men 16 years and over.	Average weekly earnings: Women 16 years and over.	Average weekly earnings: Children under 16 years.	Total: Earnings.	Total: Number.	Men 16 years and over: Earnings.	Men 16 years and over: Number.	Per cent distribution of number by earnings: Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
	MICHIGAN.																		
1	All industries	4,303	$9.92	$10.78	$5.17	$3.66	$1,200,496	120,978	$1,109,686	102,936	0.6	1.1	1.7	1.9	3.9	5.8	8.6	25.4	19.7
2	Thirteen selected industries.	1,847	10.25	10.70	5.20	3.78	624,781	60,977	600,526	56,119	0.5	1.0	1.7	1.7	4.0	6.3	9.6	25.3	20.2
3	Agricultural implements.	28	11.09	11.14	6.00	3.53	30,531	2,752	30,465	2,734	0.2	0.3	1.4	2.0	2.4	6.5	6.8	15.8	27.7
4	Carriages and wagons	136	10.25	10.35	6.64	3.00	35,263	3,439	34,702	3,354	0.8	1.6	1.9	1.9	4.9	9.3	9.3	20.5	19.3
5	Cars and general shop construction and repairs by steam railroad companies.	24	11.80	11.81	5.75	......	50,303	4,261	50,280	4,257	......	0.8	1.6	1.2	4.9	3.4	12.9	20.9	17.7
6	Chemicals	8	10.35	10.65	3.60	4.94	23,324	2,254	22,945	2,155	0.7	0.3	0.5	0.5	1.2	1.7	16.8	25.2	23.5
7	Foundry and machine shop products.	260	11.24	11.29	5.29	4.05	104,621	9,309	104,312	9,237	0.5	2.1	2.6	2.4	3.7	6.7	6.5	16.2	17.5
8	Furniture	56	9.56	9.78	5.76	4.23	58,154	6,082	56,799	5,809	0.4	0.8	3.1	2.5	5.8	10.8	13.1	22.1	19.7
9	Hosiery and knit goods	27	5.36	8.95	4.85	3.17	13,286	2,481	3,294	368	4.3	1.1	6.2	5.7	12.5	12.0	13.0	12.5	10.6
10	Lumber and timber products.	318	10.26	10.30	5.07	4.33	186,064	18,128	185,459	17,998	0.1	0.5	0.6	0.6	3.4	6.0	9.4	36.5	23.9
11	Lumber, planing mill products, including sash, doors, and blinds.	154	9.77	9.90	4.15	4.40	30,269	3,098	29,972	3,029	0.1	0.6	1.6	2.4	6.6	6.0	10.6	35.1	14.3
12	Paper and wood pulp	15	9.37	10.12	6.23	4.86	13,808	1,474	12,062	1,192	0.1	0.8	2.1	2.5	6.8	6.3	12.1	33.0	12.6
13	Printing and publishing, newspapers and periodicals.	415	9.54	11.29	5.00	2.57	22,089	2,316	19,105	1,692	4.5	4.1	4.1	5.4	5.1	5.3	5.1	10.0	14.1
14	Stoves and furnaces, not including gas and oil stoves.	12	12.07	12.22	......	5.27	29,568	2,450	29,278	2,395	......	0.3	0.4	1.3	0.7	3.9	9.6	19.8	17.5
15	Tobacco, cigars and cigarettes.	394	9.38	11.51	5.73	2.81	27,501	2,933	21,853	1,899	1.8	3.3	3.5	3.0	2.9	3.0	4.1	6.9	18.1
	MINNESOTA.																		
1	All industries	2,779	$11.01	$11.75	$6.27	$3.39	$355,647	32,314	$329,437	28,049	1.3	1.8	2.1	2.5	3.5	4.1	5.2	11.6	23.5
2	Ten selected industries.	1,253	11.45	11.79	7.07	3.14	233,561	20,390	224,313	19,028	1.4	1.8	2.1	2.2	2.9	3.6	5.7	11.9	24.2
3	Boots and shoes	7	9.67	11.07	7.13	3.00	9,576	990	7,209	651	0.1	6.6	6.1	7.1	7.8	6.0	4.0	9.1	11.7
4	Cars and general shop construction and repairs by steam railroad companies.	16	11.90	11.90	......	......	52,125	4,380	52,125	4,380	1.0	1.2	1.8	1.1	1.8	3.1	5.1	12.9	27.8
5	Flour and grist mill products.	259	12.34	12.37	6.45	3.25	39,991	3,240	39,907	3,225	0.2	0.3	0.4	1.2	1.7	2.3	7.9	9.1	24.5
6	Foundry and machine shop products.	89	12.18	12.19	8.00	......	15,222	1,250	15,182	1,245	0.5	0.6	3.1	2.1	2.7	4.0	6.5	12.5	14.1
7	Furniture	18	8.88	8.97	4.50	......	4,361	491	4,316	481	2.1	4.8	2.5	6.4	8.1	15.8	13.1	13.3	12.3
8	Lumber and timber products.	69	11.34	11.34	3.00	......	50,741	4,475	50,738	4,474	2.6	0.9	1.2	0.8	1.8	2.1	3.3	15.8	35.1
9	Lumber, planing mill products, including sash, doors, and blinds.	47	10.45	10.64	6.04	3.88	13,203	1,263	12,978	1,220	0.5	1.1	2.4	2.9	4.6	5.1	7.9	17.5	22.7
10	Printing and publishing, book and job.	92	11.46	13.16	7.77	3.00	11,968	1,044	9,500	722	1.2	6.0	6.4	6.2	5.5	6.1	4.4	4.2	7.5
11	Printing and publishing, newspapers and periodicals.	446	11.46	12.63	6.60	3.08	25,321	2,210	22,768	1,802	2.8	3.5	3.4	5.0	4.8	5.0	6.0	6.3	14.7
12	Tobacco, cigars and cigarettes.	210	10.56	11.58	7.03	2.78	11,053	1,047	9,590	828	3.0	5.8	2.8	3.3	3.9	1.9	5.3	8.4	14.5
	MISSOURI.																		
1	All industries	3,836	$10.39	$11.38	$6.02	$3.55	$778,709	74,944	$706,966	62,128	3.3	2.2	2.8	3.4	5.2	6.5	6.4	11.8	16.9
2	Ten selected industries.	1,547	10.58	11.55	6.19	3.57	325,006	30,719	295,589	25,599	3.9	2.7	2.8	3.6	5.2	6.4	6.9	11.2	14.7
3	Boots and shoes	12	9.57	12.04	7.65	3.69	35,337	3,692	24,608	2,044	2.6	3.2	2.9	4.8	7.2	7.0	9.3	5.1	9.7
4	Bread and other bakery products.	429	10.52	12.26	5.15	3.08	22,937	2,180	20,336	1,659	0.1	1.1	3.6	4.0	6.4	5.5	5.4	6.5	12.5
5	Cars and general shop construction and repairs by steam railroad companies.	20	12.46	12.46	8.00	......	53,728	4,313	53,696	4,309	1.8	1.4	1.3	1.6	2.8	4.5	6.2	16.0	18.8
6	Cars, steam railroad, not including operations of railroad companies.	4	10.46	10.47	7.64	......	47,780	4,567	47,696	4,556	11.1	4.2	3.9	3.7	4.2	4.4	6.8	10.2	16.7
7	Clothing, men's	21	7.13	13.77	6.05	2.57	11,329	1,588	3,153	229	0.4	0.9	0.9	1.8	3.1	3.9	2.6	7.0	10.0
8	Foundry and machine shop products.	118	12.43	12.48	5.43	3.95	50,688	4,079	50,563	4,050	0.7	0.8	1.4	2.6	2.5	4.6	3.9	12.9	20.0
9	Liquors, malt	29	12.16	12.50	6.68	4.05	26,904	2,212	26,399	2,112	4.8	5.1	2.9	4.8	2.5	2.6	2.3	4.4	13.6
10	Lumber and timber products.	155	8.13	8.24	3.00	4.26	23,958	2,947	23,685	2,874	3.3	3.1	3.5	4.4	12.6	18.1	16.8	21.9	8.1
11	Printing and publishing, book and job.	207	11.00	12.94	6.18	3.58	28,245	2,568	24,228	1,872	1.1	2.3	2.2	2.9	4.2	6.4	4.9	4.3	9.4
12	Printing and publishing, newspapers and periodicals.	552	9.37	11.21	4.52	2.63	24,100	2,573	21,225	1,894	6.6	4.6	5.0	5.9	8.6	6.9	6.9	8.9	13.3

[1] Less than one-tenth of 1 per cent.

DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

MEN 16 YEARS AND OVER—continued. Per cent distribution of number by earnings—Continued.				WOMEN 16 YEARS AND OVER.													CHILDREN UNDER 16 YEARS.									
				Earnings.	Number.	Per cent distribution of number by earnings.											Earnings.	Number.	Per cent distribution of number by earnings.							
$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
												MICHIGAN.														
17.9	10.8	1.8	0.8	$84,812	16,405	8.7	17.2	20.4	16.9	18.1	8.0	5.3	2.5	2.0	0.6	0.3	$5,998	1,637	28.1	31.5	26.0	8.4	4.2	1.4	0.4	1
16.5	10.6	1.9	0.7	21,571	4,148	10.0	17.7	17.4	19.2	15.6	9.2	4.5	3.0	2.0	1.1	0.3	2,684	710	23.7	29.4	31.3	8.2	5.2	1.7	0.5	2
26.4	8.1	1.8	0.6	6	1	.....	.....	.....	.....	100.0	.....	.....	.....	.....	.....	.....	60	17	.....	70.6	23.5	5.9	.....	.....	.....	3
20.1	8.7	1.5	0.2	558	84	4.8	9.5	13.1	9.5	13.1	22.6	13.1	5.9	4.8	3.6	.....	3	1	100.0	.....	.....	.....	.....	.....	.....	4
19.3	13.8	2.8	0.7	23	4	.....	25.0	.....	.....	50.0	.....	25.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5
18.7	9.7	1.0	0.2	295	82	.....	100.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	84	17	11.7	5.9	47.1	5.9	11.7	11.8	5.9	6
19.0	20.1	2.3	0.4	74	14	.....	.....	57.2	14.3	14.3	7.1	7.1	.....	.....	.....	.....	235	58	.....	51.8	36.2	1.7	8.6	.....	1.7	7
13.7	6.9	0.8	0.3	755	131	.....	17.5	18.3	22.1	22.9	8.4	3.8	0.8	3.1	2.3	0.8	600	142	4.9	30.3	40.9	14.1	7.0	2.8	.....	8
11.4	9.0	1.4	0.3	9,526	1,966	13.5	14.5	20.1	22.7	14.3	7.4	3.4	1.9	1.5	0.6	0.1	466	147	44.9	29.9	20.4	4.1	0.7	.....	.....	9
11.9	5.0	1.5	0.6	289	57	17.5	.....	22.8	24.6	26.3	1.8	1.8	1.8	1.7	1.7	.....	316	73	9.6	24.7	39.8	9.6	6.8	6.8	2.7	10
14.8	7.4	0.5	(1)	112	27	22.2	14.8	26.0	18.5	18.5	.....	.....	.....	.....	.....	.....	185	42	.....	19.1	71.4	9.5	.....	.....	.....	11
13.3	8.1	1.9	0.4	1,712	275	1.8	9.5	10.2	12.0	34.5	24.4	2.5	1.5	0.7	1.8	1.1	34	7	.....	28.6	28.6	.....	42.8	.....	.....	12
18.3	14.1	5.0	4.9	2,840	568	9.7	18.5	18.3	18.0	21.1	6.9	3.3	1.6	1.6	0.7	0.3	144	56	62.5	17.9	10.7	5.3	1.8	1.8	.....	13
15.6	24.5	4.1	2.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	290	55	.....	18.2	45.4	18.2	18.2	.....	.....	14
32.3	17.1	3.2	0.8	5,381	939	7.5	21.2	14.2	16.5	9.1	10.4	8.3	7.0	3.5	1.9	0.4	267	95	52.6	32.6	9.5	5.3	.....	.....	.....	15
												MINNESOTA.														
22.8	15.6	4.5	1.5	$25,579	4,079	6.7	13.5	14.7	14.7	15.3	10.2	8.4	4.9	6.8	3.4	1.4	$631	186	31.2	37.6	22.1	3.2	5.4	0.5	.....	1
23.0	14.7	4.8	1.7	8,943	1,265	3.9	10.5	11.2	15.0	16.0	11.0	9.6	5.3	8.5	5.1	3.9	305	97	37.1	42.3	15.5	3.1	1.0	1.0	.....	2
19.7	19.5	2.3	.....	2,331	327	3.7	14.7	11.9	10.4	10.1	8.9	8.0	7.6	15.0	7.3	2.4	30	12	58.3	41.7	.....	.....	.....	.....	.....	3
22.9	13.3	7.7	0.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
29.2	16.6	4.7	1.9	71	11	.....	9.1	.....	72.7	.....	.....	9.1	.....	.....	9.1	.....	13	4	50.0	25.0	25.0	.....	.....	.....	.....	5
21.0	27.4	5.3	0.2	40	5	20.0	.....	.....	.....	.....	.....	20.0	40.0	.....	20.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6
12.9	8.3	0.4	.....	45	10	.....	.....	100.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7
24.9	8.6	0.8	2.1	3	1	.....	100.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8
21.1	11.7	2.3	0.2	163	27	.....	.....	.....	3.7	96.3	.....	.....	.....	.....	.....	.....	62	16	.....	68.8	31.2	.....	.....	.....	.....	9
12.7	24.5	8.2	7.1	2,447	315	4.1	6.7	7.3	14.6	12.4	13.7	16.5	6.0	9.2	4.4	5.1	21	7	14.3	85.7	.....	.....	.....	.....	.....	10
17.3	17.0	8.9	5.3	2,430	368	4.4	12.8	11.1	16.0	19.0	13.3	7.6	3.8	5.4	2.5	4.1	123	40	37.5	27.5	22.5	7.5	2.5	2.5	.....	11
24.6	18.4	7.1	1.0	1,413	201	3.5	7.5	14.4	20.9	16.9	8.9	6.5	3.5	5.0	7.9	5.0	50	18	61.1	38.9	.....	.....	.....	.....	.....	12
												MISSOURI.														
18.9	17.0	3.7	1.9	$63,937	10,617	6.3	10.4	16.3	16.9	19.7	12.0	7.0	4.3	4.3	2.1	0.7	$7,806	2,199	24.5	31.0	31.6	7.7	4.2	0.6	0.4	1
16.6	18.9	4.2	2.9	26,318	4,251	5.4	12.3	13.1	16.8	19.4	12.4	6.5	4.0	6.0	3.1	1.0	3,099	869	22.7	30.8	35.2	8.4	1.8	0.5	0.6	2
18.2	22.9	5.5	1.6	8,975	1,173	4.0	7.3	8.6	11.6	10.6	14.2	11.5	6.7	14.1	9.0	2.4	1,754	475	15.8	28.8	47.0	8.4	.....	.....	.....	3
24.7	25.2	2.9	2.1	2,478	481	0.4	29.7	16.2	18.3	26.0	4.0	3.3	1.5	0.4	0.2	.....	123	40	60.0	17.5	10.0	10.0	.....	.....	2.5	4
20.3	20.5	3.6	1.2	32	4	.....	.....	.....	.....	.....	75.0	.....	25.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5
15.2	10.8	2.8	6.0	84	11	.....	.....	.....	.....	.....	81.8	18.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6
25.3	34.1	9.6	0.4	8,140	1,345	5.1	4.8	14.8	23.2	25.0	11.5	5.6	3.9	5.0	1.1	.....	36	14	85.7	14.3	.....	.....	.....	.....	.....	7
17.7	25.7	5.6	1.6	38	7	14.3	.....	14.3	42.8	14.3	14.3	.....	.....	.....	.....	.....	87	22	.....	31.8	59.1	9.1	.....	.....	.....	8
18.8	31.6	5.0	1.6	254	38	5.3	.....	2.6	15.8	23.7	23.7	18.4	10.5	.....	.....	.....	251	62	19.4	25.8	30.6	19.4	1.6	3.2	.....	9
4.4	2.7	0.5	0.6	90	30	40.0	56.7	.....	.....	.....	.....	.....	3.3	.....	.....	.....	183	43	21.0	32.5	13.9	.....	23.3	2.3	7.0	10
20.6	30.6	7.7	3.4	3,623	586	1.4	8.5	10.4	15.5	29.2	23.7	5.0	2.1	1.7	1.0	1.5	394	110	2.7	60.0	25.5	8.2	3.6	.....	.....	11
11.5	7.1	6.1	8.6	2,604	576	15.6	28.3	20.1	13.4	10.3	4.7	2.1	2.1	1.7	0.5	1.2	271	103	60.2	18.4	12.6	5.8	1.0	1.0	1.0	12

TABLE 72.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE STATES, BY SELECTED INDUSTRIES—PER CENT AVERAGE WEEKLY EARNINGS, AND NUMBER OF ALL WAGE-EARNERS, AND

NEW HAMPSHIRE.

	INDUSTRY.	Number of establishments.	AVERAGE WEEKLY EARNINGS.				TOTAL.		MEN 16 YEARS AND OVER.										
			All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Earnings.	Number.	Earnings.	Number.	Per cent distribution of number by earnings.								
											Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	810	$9.04	$10.03	$6.99	$4.04	$270,034	29,874	$205,379	20,473	1.5	1.7	2.6	4.5	8.1	11.5	9.8	16.9	17.2
2	Six selected industries.	237	8.55	9.65	7.06	4.09	182,471	21,330	122,317	12,673	1.8	1.7	3.3	5.0	9.5	13.1	10.2	15.4	17.7
3	Boots and shoes	24	9.23	10.35	7.31	4.30	45,742	4,956	33,221	3,209	3.1	2.2	4.0	5.6	5.9	8.7	8.0	11.6	18.3
ıı	Cotton goods	5	7.80	8.67	7.05	4.18	78,894	10,117	43,302	4,993	1.7	1.8	3.8	6.8	14.8	17.5	13.3	11.9	16.1
5	Foundry and machine shop products.	40	11.22	11.25	6.00	3.40	16,736	1,492	16,707	1,485	0.4	1.7	3.0	2.6	5.9	7.4	5.4	13.7	16.6
ʊ	Hosiery and knit goods	12	7.18	8.88	6.60	2.36	10,659	1,485	3,800	428	3.3	2.3	3.0	4.0	9.3	18.7	14.3	13.1	15.7
7	Lumber and timber products.	141	9.83	9.84	6.50	......	11,954	1,216	11,941	1,214	0.2	0.1	1.1	0.9	4.2	9.1	7.9	40.2	20.2
8	Woolen goods	15	8.96	9.93	7.24	4.70	18,486	2,064	13,346	1,344	1.0	1.0	2.4	3.4	7.0	15.0	10.3	17.9	21.6

NEW JERSEY.

	INDUSTRY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	4,153	$10.41	$11.75	$6.03	$3.55	$1,456,513	139,862	$1,276,999	108,669	1.6	2.1	2.9	3.4	4.8	6.7	8.4	12.4	15.6
2	Eighteen selected industries.	1,617	10.46	11.84	6.36	3.47	712,258	68,084	615,152	51,969	1.4	2.0	2.6	3.2	4.3	6.6	9.0	12.7	15.5
3	Boots and shoes	21	8.61	10.40	6.47	3.26	8,001	929	5,604	539	1.9	1.9	5.2	5.9	5.6	8.5	7.0	10.8	12.8
4	Bread and other bakery products.	822	11.96	12.37	5.70	3.73	38,449	3,215	37,534	3,034	0.5	0.9	1.4	1.7	2.7	2.8	5.3	6.2	15.7
5	Cars and general shop construction and repairs by steam railroad companies.	14	12.29	12.32	7.26	......	57,565	4,682	57,398	4,659	0.5	0.6	0.8	1.3	2.7	2.7	17.9	15.0	11.6
6	Chemicals	26	10.18	10.95	5.55	......	23,537	2,312	21,701	1,981	0.8	0.9	1.1	2.7	3.5	4.8	6.5	23.9	19.4
7	Clothing, women's	25	6.28	11.19	5.93	3.20	6,843	1,090	1,074	96	2.1	......	......	1.0	4.2	1.0	34.4	4.2	27.1
8	Cotton goods	10	7.94	11.01	6.69	3.76	25,052	3,154	12,296	1,117	0.5	0.8	2.8	5.2	8.9	11.7	5.4	9.6	13.1
9	Dyeing and finishing textiles.	20	9.82	10.18	5.95	3.74	31,241	3,181	29,746	2,921	0.4	0.7	2.3	2.9	4.0	12.6	12.2	10.5	36.0
10	Electrical machinery, apparatus, and supplies.	15	8.37	10.84	6.60	3.12	35,407	4,230	19,912	1,837	4.6	3.2	5.0	5.8	6.5	8.9	7.7	6.7	14.3
11	Foundry and machine shop products.	207	11.45	11.64	5.61	4.26	161,998	14,144	159,911	13,741	1.7	2.7	2.9	3.2	3.6	6.5	8.2	12.6	14.3
12	Glass	5	13.19	14.63	4.09	3.96	21,827	1,655	20,935	1,431	0.4	5.9	7.5	3.6	13.3	7.6	2.4	10.8	6.5
13	Hats, felt	37	13.39	15.14	7.72	3.50	44,894	3,352	38,812	2,563	0.3	0.2	1.4	3.2	2.2	4.8	4.3	6.1	10.3
14	Iron and steel, steel works and rolling mills.	10	10.92	10.99	5.47	......	44,449	4,072	44,148	4,017	2.5	2.3	2.4	3.2	4.6	9.7	14.0	14.1	15.1
15	Leather, tanned, curried, and finished.	31	12.65	12.83	5.62	4.43	24,775	1,959	24,552	1,913	0.1	0.4	0.2	2.1	1.4	7.0	6.6	14.4	21.1
16	Petroleum, refining	4	11.96	12.28	7.00	4.45	48,673	4,070	47,928	3,903	1.4	0.9	1.5	1.5	3.2	4.3	6.3	18.1	14.9
17	Pottery, terra cotta, and fire clay products.	34	12.07	12.55	5.07	4.06	50,105	4,151	48,795	3,889	1.3	0.6	2.1	3.4	4.2	8.4	11.2	18.2	15.0
18	Silk and silk goods	55	8.70	10.92	7.30	3.23	52,351	6,015	28,152	2,577	2.3	3.9	4.8	5.4	5.8	6.2	7.0	8.2	14.5
19	Tobacco, cigars and cigarettes.	276	6.53	9.71	5.38	2.64	30,673	4,695	13,730	1,414	1.8	6.9	6.8	8.1	9.2	7.4	6.9	6.7	14.1
20	Worsted goods	5	5.45	8.68	4.90	2.82	6,418	1,178	2,924	337	......	8.3	14.8	9.8	11.6	6.8	4.8	7.1	5.9

NEW YORK.

	INDUSTRY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	19,030	$10.40	$11.79	$6.54	$3.64	$4,476,464	430,475	$3,755,060	318,390	1.6	2.2	3.0	3.6	4.9	6.8	7.4	12.6	15.6
2	Twenty-nine selected industries.	10,583	10.34	11.94	6.80	3.50	2,472,260	239,210	1,980,015	165,843	1.6	2.1	2.8	3.2	4.8	6.6	7.0	12.5	15.3
3	Bookbinding and blank book making.	141	9.08	12.09	6.13	3.63	38,565	4,245	25,912	2,143	0.9	3.1	5.5	6.0	7.4	5.7	7.3	7.6	12.9
4	Boots and shoes	71	9.35	10.64	7.03	3.02	66,017	7,064	49,857	4,686	2.2	2.7	4.6	6.2	7.8	9.5	9.3	9.9	16.1
5	Boxes, fancy and paper	119	7.32	10.13	5.65	2.71	38,549	5,264	20,862	2,060	1.8	3.7	6.2	6.1	8.2	6.8	7.1	9.6	18.8
6	Bread and other bakery products.	2,394	11.36	12.52	5.30	3.46	139,916	12,316	129,837	10,374	0.6	1.2	1.5	2.1	2.9	3.0	4.3	6.1	15.8
7	Brick and tile	74	10.35	10.38	......	4.50	43,061	4,160	42,962	4,138	0.9	0.8	1.6	1.8	3.4	6.6	6.4	24.1	28.4
8	Canning and preserving, fruits and vegetables.	257	6.35	8.59	4.71	3.32	46,654	7,350	26,897	3,130	6.6	2.4	2.6	3.0	9.0	15.4	4.6	29.5	12.8
9	Carriages and wagons	396	11.88	11.97	5.90	3.00	55,284	4,652	54,950	4,589	1.2	1.2	1.4	1.7	3.2	3.9	4.8	10.4	21.0
10	Cars and general shop construction and repairs by steam railroad companies.	33	11.31	11.31	9 50	......	89,384	7,905	89,365	7,903	0.8	1.0	0.8	1.2	1.9	7.0	10.6	20.8	18.7
11	Clothing, men's	657	9.83	12.30	6.47	3.36	158,798	16,162	115,189	9,362	1.1	2.8	3.9	4.8	5.2	6.4	6.4	6.8	14.4
12	Clothing, women's	551	10.31	13.67	7.68	3.44	222,133	21,555	130,276	9,532	0.5	1.2	1.4	2.7	3.8	5.0	6.8	8.9	15.0
13	Collars and cuffs	7	8.04	10.24	7.68	3.49	52,239	6,498	10,944	1,069	3.3	5.0	7.5	8.0	9.1	8.6	6.0	8.0	13.6
14	Confectionery	104	7.12	10.73	5.09	3.35	27,606	3,877	15,056	1,403	0.3	1.8	3.2	5.1	12.6	9.3	6.7	9.5	16.0
15	Foundry and machine shop products.	710	12.04	12.13	5.90	3.74	361,088	29,985	358,831	29,588	1.4	2.5	2.8	2.7	3.5	5.4	6.6	12.5	14.6
16	Furniture	257	10.39	10.54	5.52	3.48	90,399	8,702	89,119	8,458	1.3	1.9	3.1	3.8	5.9	9.9	10.0	13.0	16.9
17	Gas, illuminating and heating.	47	11.02	11.02	4.50	......	18,021	1,636	18,012	1,634	2.7	1.5	4.0	2.7	4.5	3.6	7.1	16.0	18.0
18	Hosiery and knit goods	87	7.70	9.06	7.12	4.15	85,725	11,129	34,798	3,842	1.4	1.7	3.3	3.2	12.1	18.3	15.4	14.3	15.6
19	Iron and steel, steel works and rolling mills.	11	11.39	11.49	6.60	......	37,210	3,266	36,794	3,203	1.0	0.9	1.0	2.0	4.3	9.2	15.4	20.9	17.8

[1] Less than one-tenth of 1 per cent.

DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

NEW HAMPSHIRE.

MEN 16 YEARS AND OVER—continued. Per cent distribution of number by earnings—Continued. $12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	WOMEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	CHILDREN UNDER 16 YEARS. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
14.9	9.5	1.5	0.3	$63,178	9,035	3.2	4.6	8.8	14.7	21.5	14.3	10.9	9.8	9.3	2.4	0.5	$1,477	366	11.5	38.5	31.1	11.2	6.3	1.4	.....	1
13.4	7.3	1.4	0.2	58,799	8,326	3.1	4.3	8.6	14.1	21.4	14.4	11.4	9.9	9.8	2.5	0.5	1,355	331	10.3	37.2	32.6	12.1	6.3	1.5	.....	2
19.4	10.0	2.8	0.4	12,164	1,664	5.9	5.8	9.8	11.9	12.7	13.6	11.2	10.7	10.9	5.9	1.6	357	83	1.2	35.0	44.6	10.8	6.0	2.4	.....	3
8.4	2.9	0.8	0.2	34,818	4,939	1.4	3.9	7.7	13.6	25.7	14.7	11.8	9.8	10.1	1.3	.....	774	185	6.5	42.2	31.9	12.4	6.5	0.5	.....	4
19.9	21.8	1.4	0.2	12	2	.....	50.0	.....	.....	.....	50.0	.....	.....	.....	.....	.....	17	5	20.0	80.0	.....	.....	.....	.....	.....	5
11.9	3.0	0.9	0.5	6,793	1,029	6.8	5.2	8.2	19.0	18.1	12.8	11.7	10.5	6.3	1.4	.....	66	28	67.9	17.8	10.7	3.6	.....	.....	.....	6
9.9	4.9	1.2	0.1	13	2	.....	.....	.....	50.0	.....	50.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7
14.1	5.6	0.7	.....	4,999	690	2.7	2.7	12.5	15.4	16.9	15.8	8.3	9.0	10.6	4.2	1.9	141	30	3.4	23.3	30.0	23.3	13.3	6.7	.....	8

NEW JERSEY.

$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	Women: Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Children: Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
16.9	18.0	4.8	2.4	$167,088	27,690	8.0	11.5	16.1	17.4	15.2	12.0	8.2	4.8	3.9	2.1	0.8	$12,426	3,503	25.7	38.1	25.0	7.1	3.1	0.5	0.5	1
16.6	18.8	4.7	2.6	90,666	14,257	7.0	9.0	14.1	16.3	15.2	14.9	10.0	5.4	4.3	2.8	1.0	6,440	1,858	26.0	38.2	25.9	6.2	3.3	0.3	0.1	2
22.3	14.6	3.1	0.4	2,270	351	1.1	9.1	19.4	18.5	12.0	9.1	9.1	10.0	5.7	6.0	.....	127	39	12.8	71.8	10.2	2.6	2.6	.....	.....	3
32.4	27.7	2.2	0.5	695	122	.....	13.1	21.3	24.6	13.1	10.7	9.0	4.9	0.8	1.7	0.8	220	59	23.7	33.9	25.4	3.4	6.8	6.8	.....	4
17.7	21.9	4.7	2.6	167	23	.....	.....	.....	.....	91.3	.....	.....	4.3	4.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5
18.1	14.6	2.9	0.8	1,836	331	2.7	10.6	21.4	21.2	13.6	13.9	10.3	3.3	1.8	0.9	0.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	6
3.1	15.6	7.3	.....	5,625	949	9.1	9.9	12.3	16.3	19.8	13.2	8.6	4.7	3.3	1.9	0.9	144	45	66.7	4.4	.....	28.9	.....	.....	.....	7
15.6	15.3	9.7	1.4	11,647	1,742	0.6	3.3	7.0	10.5	19.7	31.3	21.2	4.2	2.0	0.2	.....	1,109	295	9.2	30.8	49.8	4.1	5.1	0.7	0.3	8
10.5	5.2	1.5	1.2	1,409	237	0.4	4.6	22.4	20.3	31.6	13.1	1.3	1.3	0.8	2.1	2.1	86	23	17.4	39.1	34.8	4.3	4.4	.....	.....	9
13.8	18.0	4.3	1.2	15,236	2,310	5.7	5.1	11.6	17.1	17.7	17.2	14.0	6.7	4.4	0.4	0.1	259	83	38.6	47.0	8.4	4.8	1.2	.....	.....	10
17.7	22.0	3.7	0.9	1,538	274	0.7	3.3	12.4	56.9	15.7	5.1	0.7	1.5	1.5	0.7	1.5	549	129	6.2	31.8	44.2	9.3	8.5	.....	.....	11
3.8	7.7	3.7	26.8	139	34	.....	38.2	61.8	.....	.....	.....	.....	.....	.....	.....	.....	753	190	1.6	66.8	29.5	1.6	0.5	.....	.....	12
18.3	27.1	15.2	6.6	6,075	787	1.0	3.6	5.8	12.4	10.8	18.3	15.1	14.4	11.9	5.1	1.6	7	2	.....	100.0	.....	.....	.....	.....	.....	13
14.7	12.1	3.2	2.1	301	55	.....	.....	72.7	20.0	.....	7.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	14
19.8	17.7	6.4	2.8	90	16	.....	.....	.....	43.8	50.0	6.2	.....	.....	.....	.....	.....	133	30	.....	.....	56.7	43.3	.....	.....	.....	15
12.8	29.6	4.2	1.3	7	1	.....	.....	.....	.....	100.0	.....	.....	.....	.....	.....	.....	738	166	.....	13.9	54.2	18.7	13.2	.....	.....	16
8.8	12.2	8.4	6.2	1,237	244	10.7	13.1	30.7	16.4	13.9	11.1	1.2	2.1	0.4	.....	0.4	73	18	16.7	27.8	22.2	11.1	22.2	.....	.....	17
20.0	15.1	5.8	1.0	23,478	3,215	6.6	9.2	10.4	10.3	13.7	12.3	8.7	8.6	8.2	8.5	3.5	721	223	40.4	39.0	13.9	5.4	0.9	.....	0.4	18
17.6	12.7	1.8	.....	16,267	3,025	16.9	16.1	17.9	15.3	13.1	11.3	5.3	1.6	1.6	0.9	(1)	676	256	55.1	33.6	8.6	2.7	.....	.....	.....	19
16.0	14.0	0.3	0.6	2,649	541	.....	10.9	35.9	49.3	3.5	0.4	.....	.....	.....	.....	.....	845	300	42.0	50.0	7.3	0.7	.....	.....	.....	20

NEW YORK.

$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	Women: Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Children: Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
18.0	16.2	5.2	2.9	$706,850	108,083	6.5	10.1	15.0	15.5	14.7	11.4	8.5	6.4	6.4	3.7	1.8	$14,554	4,002	21.9	42.9	22.9	8.5	2.6	0.8	0.4	1
18.1	18.0	5.2	2.8	485,066	71,313	5.9	9.2	13.8	14.3	14.6	12.2	9.1	7.2	7.3	4.3	2.1	7,179	2,054	28.9	39.3	20.2	7.6	3.1	0.5	0.4	2
15.0	19.0	7.5	2.1	12,319	2,010	3.5	16.1	17.8	16.3	14.4	10.5	8.0	5.8	4.8	2.1	0.7	334	92	19.6	45.6	27.2	4.3	3.3	.....	.....	3
16.3	9.7	4.1	1.6	15.746	2,241	4.3	7.7	12.5	12.8	15.0	13.1	12.4	6.7	8.9	5.2	1.4	414	137	46.0	38.0	10.9	4.4	0.7	.....	.....	4
16.2	12.3	2.4	0.8	17,291	3,058	6.6	15.5	19.7	18.3	15.7	9.6	6.1	4.4	2.9	0.9	0.3	396	146	56.8	27.4	12.3	1.4	2.1	.....	.....	5
31.5	27.7	2.9	0.4	9,667	1,823	8.3	12.7	16.9	23.7	18.6	7.7	5.3	3.0	2.8	0.9	0.1	412	119	45.4	21.8	11.8	9.2	5.9	2.5	3.4	6
19.3	5.1	1.1	0.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	99	22	13.6	27.3	13.6	31.8	9.1	4.6	.....	7
10.6	2.7	0.7	0.1	19,465	4,132	12.1	8.9	40.3	18.8	11.0	5.6	1.6	1.4	0.3	.....	.....	292	88	34.1	40.9	15.9	5.7	3.4	.....	.....	8
26.6	20.6	3.1	0.9	295	50	4.0	4.0	8.0	40.0	20.0	8.0	12.0	2.0	.....	2.0	.....	39	13	53.8	23.1	7.7	7.7	7.7	.....	.....	9
21.7	14.0	1.4	0.1	19	2	.....	.....	.....	.....	.....	50.0	.....	.....	50.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10
16.5	17.7	10.6	3.4	43,226	6,686	6.2	9.2	12.5	16.0	17.3	12.9	9.2	7.0	5.8	2.7	1.2	383	114	33.3	43.0	15.8	3.5	1.8	2.6	.....	11
18.7	19.1	10.2	6.7	91,489	11,916	4.0	6.5	8.9	11.8	13.7	13.0	10.9	9.6	10.8	6.8	4.0	368	107	20.6	50.4	24.3	4.7	.....	.....	.....	12
12.5	11.9	3.1	3.4	40,949	5,330	5.7	9.6	8.7	8.9	10.8	10.9	11.2	8.9	12.1	9.1	4.1	346	99	6.1	64.7	24.2	4.0	1.0	.....	.....	13
18.7	12.7	2.3	1.8	12,446	2,443	7.1	26.8	20.5	19.3	10.2	6.4	3.8	2.8	2.1	0.8	0.2	104	31	9.7	74.2	16.1	.....	.....	.....	.....	14
17.9	24.2	4.5	1.4	2,111	358	1.4	7.5	24.9	21.0	19.8	15.9	3.9	3.6	0.8	0.6	0.6	146	39	17.9	43.6	20.5	7.7	10.3	.....	.....	15
19.7	11.2	2.8	0.5	1,165	211	13.7	16.6	22.3	12.8	13.3	6.2	2.4	2.4	4.2	4.2	1.9	115	33	12.1	60.6	21.2	6.1	.....	.....	.....	16
18.8	17.8	2.2	1.1	9	2	.....	.....	50.0	50.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17
8.2	4.8	1.1	0.6	49,584	6,963	2.8	5.1	9.0	13.4	16.0	18.3	13.5	11.6	6.5	3.4	0.4	1,343	324	10.5	34.2	32.1	16.4	6.5	0.3	.....	18
12.7	6.9	4.2	3.7	416	63	3.2	11.1	6.4	9.5	27.0	20.6	7.9	6.4	7.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	19

TABLE 72.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE STATES, BY SELECTED INDUSTRIES—PER CENT AVERAGE WEEKLY EARNINGS, AND NUMBER OF ALL WAGE-EARNERS, AND

NEW YORK—Continued.

	INDUSTRY.	Number of establishments.	Average weekly earnings: All wage-earners.	Average weekly earnings: Men 16 years and over.	Average weekly earnings: Women 16 years and over.	Average weekly earnings: Children under 16 years.	Total: Earnings.	Total: Number.	Men 16 years and over: Earnings.	Men 16 years and over: Number.	Per cent distribution of number by earnings: Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
20	Liquors, malt	105	$15.80	$15.82	$5.17	$4.00	$56,297	3,564	$56,262	3,557	0.3	0.1	0.3	0.7	0.7	1.0	0.9	2.8	5.4
21	Lumber and timber products.	463	9.59	9.61	5.46	2.83	46,372	4,836	46,284	4,817	0.6	0.7	1.2	1.0	7.7	14.1	8.2	35.1	16.4
22	Lumber, planing mill products, including sash, doors, and blinds.	308	12.37	12.40	6.90	3.79	85,098	6,880	84,907	6,846	0.8	1.5	2.6	2.8	4.5	5.8	6.4	13.0	12.9
23	Millinery and lace goods	195	8.47	13.23	7.63	3.43	52,218	6,166	12,697	960	1.9	2.4	3.1	4.7	5.7	7.0	6.7	5.5	13.1
24	Musical instruments, pianos.	44	12.96	13.01	....	3.17	32,829	2,533	32,791	2,521	1.4	1.6	3.1	4.4	5.2	4.5	5.0	6.5	13.1
25	Paper and wood pulp	81	10.11	10.28	5.12	3.32	80,967	8,009	79,666	7,748	3.5	1.7	2.0	1.9	4.1	7.6	8.0	25.6	20.0
26	Printing and publishing, book and job.	865	12.14	13.38	7.30	3.78	138,833	11,433	123,012	9,196	4.3	3.8	4.7	4.5	4.7	4.6	5.1	6.1	8.5
27	Printing and publishing, newspapers and periodicals.	666	14.35	16.22	7.26	3.12	122,676	8,550	110,297	6,801	2.8	2.6	2.9	3.4	4.2	3.8	3.7	6.1	10.2
28	Shirts	83	7.29	10.08	6.29	4.00	28,722	3,938	10,526	1,044	1.5	5.4	7.0	6.7	10.1	9.4	5.1	7.7	16.5
29	Silk and silk goods	43	7.68	12.26	5.68	3.49	37,504	4,884	18,936	1,545	1.2	3.2	4.8	5.2	5.0	4.3	5.1	7.2	10.4
30	Structural ironwork	105	12.98	12.98	5.50	....	55,568	4,282	55,557	4,280	0.9	0.8	1.4	1.9	4.0	8.2	6.8	9.3	18.8
31	Tobacco, cigars and cigarettes.	1,709	8.96	10.56	7.36	3.36	164,527	18,369	99,419	9,414	1.7	4.1	4.8	5.7	7.0	5.8	7.9	8.7	15.9

NORTH CAROLINA.

	INDUSTRY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total: Earnings.	Total: Number.	Men: Earnings.	Men: Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	1,698	$4.96	$5.92	$3.60	$2.58	$254,059	51,240	$197,094	33,283	8.8	10.7	21.1	15.7	18.8	8.9	4.3	4.0	2.8
2	Seven selected industries.	775	4.76	5.76	3.59	2.58	197,219	41,412	147,426	25,614	8.9	11.4	22.4	16.0	19.1	8.5	3.9	3.6	2.5
3	Cars and general shop construction and repairs by steam railroad companies.	5	10.13	10.15	....	3.25	18,468	1,823	18,455	1,819	1.9	1.7	7.7	7.6	14.6	11.4	10.2	7.5	15.1
4	Cotton goods	106	4.19	5.33	3.82	2.64	87,220	20,830	48,087	9,023	8.3	12.8	25.9	17.5	18.3	7.0	3.7	3.6	1.3
5	Furniture	41	5.66	5.88	....	2.67	12,091	2,138	11,698	1,991	7.2	7.8	15.1	19.3	23.2	14.6	3.2	4.8	2.5
6	Hosiery and knit goods	18	3.78	5.99	3.53	2.56	4,839	1,281	1,760	294	11.2	11.2	14.0	12.3	25.5	6.1	5.8	6.1	4.1
7	Lumber and timber products.	523	5.37	5.40	2.50	2.65	43,507	8,097	43,330	8,030	12.8	11.3	23.6	13.0	21.5	7.9	3.3	2.7	1.6
8	Lumber, planing mill products, including sash, doors, and blinds.	67	5.87	5.97	....	2.22	7,130	1,215	7,059	1,183	5.8	6.3	26.0	15.6	17.9	11.6	4.6	5.8	2.7
9	Tobacco, chewing and smoking, and snuff.	15	3.98	5.20	2.64	2.33	23,964	6,028	17,037	3,274	6.6	17.5	22.3	21.9	14.9	7.8	2.6	2.1	1.3

OHIO.

	INDUSTRY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total: Earnings.	Total: Number.	Men: Earnings.	Men: Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	8,328	$10.63	$11.49	$5.43	$3.61	$2,614,720	245,944	$2,435,737	211,989	1.6	1.9	2.6	3.2	4.3	6.3	8.6	15.2	16.8
2	Twenty-one selected industries.	5,049	11.01	11.75	5.74	3.59	1,622,027	147,217	1,526,859	129,988	1.5	1.7	2.5	2.9	3.9	6.2	9.1	14.8	16.5
3	Agricultural implements	40	10.92	10.96	6.92	3.00	56,267	5,152	55,918	5,101	0.7	1.2	2.1	2.3	3.6	7.6	15.1	15.4	18.0
4	Boots and shoes	30	8.26	10.13	6.16	3.25	74,707	9,046	51,931	5,127	2.8	6.3	7.2	7.3	7.8	7.4	7.4	9.4	11.3
5	Bread and other bakery products.	888	9.87	11.07	4.38	4.13	37,203	3,771	34,243	3,092	0.9	1.3	2.4	3.5	5.6	5.5	5.6	8.5	19.4
6	Brick and tile	335	9.67	9.76	5.00	3.93	42,973	4,446	42,701	4,377	1.9	1.4	1.7	1.6	5.4	8.3	13.6	31.7	14.2
7	Carriages and wagons	224	10.62	10.77	5.89	3.67	43,597	4,105	42,891	3,984	0.8	2.1	3.1	3.2	5.3	7.9	9.3	15.5	16.0
8	Cars and general shop construction and repairs by steam railroad companies.	43	12.32	12.33	8.40	....	172,459	13,994	172,291	13,974	1.0	0.5	1.0	2.4	2.6	5.3	7.7	14.0	19.4
9	Clothing, men's	223	7.77	11.96	5.65	3.00	30,301	3,901	15,978	1,336	1.4	1.6	2.3	3.9	5.7	5.3	5.6	8.7	14.0
10	Clothing, women's	69	7.34	11.27	5.70	2.25	14,084	1,918	6,392	567	0.4	0.7	5.0	7.4	10.6	10.4	5.8	9.0	12.5
11	Electrical machinery, apparatus, and supplies.	54	9.62	10.31	6.00	3.00	29,284	3,043	26,486	2,568	1.4	2.0	4.1	4.0	4.6	8.7	11.2	17.5	13.2
12	Foundry and machine shop products.	516	11.31	11.35	5.79	3.46	334,890	29,617	334,180	29,451	2.0	2.2	2.9	3.2	4.1	5.5	8.0	14.8	15.5
13	Furniture	97	9.22	9.58	4.62	3.50	39,035	4,232	37,664	3,932	2.0	3.7	4.8	6.7	8.0	11.2	9.1	13.8	14.5
14	Glass	12	12.93	15.11	4.97	4.15	43,875	3,393	40,753	2,697	0.5	0.8	9.7	5.9	2.3	11.5	11.2	7.1	6.2
15	Iron and steel, blast furnaces.	17	13.01	13.01	5.00	....	64,835	4,984	64,830	4,983	1.4	0.4	0.8	0.6	0.6	1.0	1.9	6.8	27.7
16	Iron and steel, steel works and rolling mills.	35	13.71	13.81	5.62	5.40	344,603	25,139	342,887	24,830	0.3	0.3	0.7	1.0	1.4	3.9	11.4	12.4	19.6
17	Lumber and timber products.	506	8.91	8.93	4.17	2.17	41,763	4,686	41,700	4,668	3.4	1.4	2.1	2.5	7.7	13.9	7.6	35.5	12.4
18	Lumber, planing mill products, including sash, doors, and blinds.	273	10.78	10.91	3.37	4.57	43,003	3,989	42,705	3,913	1.1	1.6	2.8	3.6	4.2	6.6	8.9	15.6	13.4
19	Pottery, terra cotta, and fire clay products.	70	9.82	10.39	6.08	3.00	49,120	5,000	45,142	4,343	3.3	1.5	1.7	2.2	3.2	7.8	11.9	30.8	13.7
20	Printing and publishing, book and job.	296	9.56	11.15	5.57	3.34	26,512	2,773	22,464	2,015	2.1	5.8	4.7	5.6	7.5	6.8	5.7	7.7	11.8
21	Printing and publishing, newspapers and periodicals.	556	10.91	12.77	5.14	2.52	47,510	4,355	42,298	3,311	3.3	3.7	4.3	3.8	6.3	4.9	5.1	6.8	11.7
22	Stoves and furnaces, not including gas and oil stoves.	33	11.83	11.88	....	3.67	35,009	2,959	34,943	2,941	2.6	2.2	3.4	4.4	3.8	7.7	13.8	10.0	12.5
23	Tobacco, cigars and cigarettes.	732	7.60	10.25	5.89	2.88	50,997	6,714	28,462	2,778	1.7	2.5	2.2	3.4	7.8	5.1	7.4	12.0	21.6

[1] Less than one-tenth of 1 per cent.

DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

NEW YORK—Continued.

MEN 16 YEARS AND OVER—continued. Per cent distribution of number by earnings—Continued. $12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	WOMEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	CHILDREN UNDER 16 YEARS. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
21.8	55.9	8.2	1.9	$31	6	16.6	16.6		16.7	16.7	16.7	16.7					$4	1			100.0					20
7.1	5.6	1.9	0.4	71	13	7.6		38.5	15.4		38.5						17	6	50.0	50.0						21
18.0	23.5	7.1	1.1	138	20			25.0	10.0	25.0	20.0	5.0	10.0	5.0			53	14	14.3	50.0	28.6	7.1				22
16.4	14.9	10.9	7.7	39,360	5,159	5.7	7.4	10.0	12.2	13.3	10.7	10.2	8.0	9.7	7.9	4.9	161	47	23.4	49.0	23.4	2.1	2.1			23
18.7	23.9	8.3	4.3														38	12	8.3	83.3	8.4					24
14.3	7.8	2.6	0.9	1,238	242	6.2	4.6	41.3	20.3	22.7	2.9	0.4	0.4	0.4	0.8		63	19	21.0	47.4	31.6					25
15.1	20.1	11.1	7.4	15,276	2,093	12.0	9.3	10.8	13.6	12.9	10.0	7.2	5.5	8.5	4.5	5.7	545	144	19.4	35.4	25.0	13.2	4.9	1.4	0.7	26
12.5	15.9	10.6	21.3	12,145	1,674	4.9	9.5	13.4	13.9	18.9	10.5	7.9	3.9	5.9	4.1	7.1	234	75	41.4	25.3	20.0	12.0	1.3			27
14.8	11.6	2.6	1.6	18,192	2,893	12.7	9.6	12.0	14.1	14.6	11.6	8.2	6.0	6.5	3.6	1.1	4	1		100.0						28
17.3	29.0	4.8	2.5	17,944	3,160	8.2	13.6	19.8	19.5	15.0	7.7	5.6	3.5	4.0	2.3	0.8	624	179	24.6	50.8	19.0	2.8	1.1		1.7	29
16.3	21.2	8.6	1.8	11	2				50.0	50.0																30
22.0	13.3	2.3	0.8	64,463	8,763	3.3	6.2	10.5	12.7	16.3	17.3	10.2	8.4	9.6	4.7	0.8	645	192	50.5	26.6	13.5	7.3	1.6		0.5	31

NORTH CAROLINA.

$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	Women: Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Children: Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
2.3	2.0	0.4	0.2	$37,452	10,397	28.2	32.4	23.5	10.0	4.4	1.1	0.2	0.1	0.1			$19,513	7,560	64.5	28.1	6.0	1.2	0.2	(1)	(1)	1
1.5	1.6	0.4	0.2	32,095	8,943	28.9	32.3	23.5	9.7	4.3	0.9	0.2	0.1	0.1			17,698	6,855	64.0	29.5	5.2	1.1	0.2	(1)	(1)	2
7.2	11.3	2.7	1.1														13	4		100.0						3
0.9	0.6	0.1		25,791	6,747	18.3	35.2	29.3	11.6	4.2	1.0	0.2	0.1	0.1			13,342	5,060	60.5	33.7	4.7	1.0	0.1			4
1.6	0.6	0.1															393	147	65.3	25.9	8.8					5
2.0	1.4	0.3		2,008	569	33.9	33.0	12.5	7.9	11.8	0.5		0.2	0.2			1,071	418	56.5	38.3	3.6	1.4	0.2			6
1.1	0.7	0.3	0.2	5	2	50.0		50.0									172	65	69.2	30.8						7
2.4	1.0	0.1	0.2														71	32	78.1	21.9						8
0.9	1.9	0.2	(1)	4,291	1,625	71.0	19.8	3.3	2.5	2.2	0.7	0.5					2,636	1,129	81.7	8.1	7.6	1.5	0.7	0.3	0.1	9

OHIO.

$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	Women: Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Children: Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
19.1	14.9	3.4	2.1	$168,284	30,989	9.6	16.2	20.0	18.6	13.5	9.0	5.2	3.4	2.8	1.3	0.4	$10,699	2,966	29.9	34.1	17.1	10.2	7.6	0.8	0.3	1
19.3	15.0	3.9	2.7	89,000	15,513	9.2	14.2	17.1	19.4	13.2	10.0	6.4	4.4	3.6	1.9	0.6	6,168	1,716	31.1	35.3	15.7	7.7	9.2	0.6	0.4	2
17.7	12.4	3.5	0.4	346	50		6.0	20.0	14.0	28.0	10.0	16.0	4.0		2.0		3	1		100.0						3
14.5	14.4	3.3	0.9	21,240	3,447	8.2	14.5	14.4	17.6	12.4	11.2	8.0	6.2	4.5	2.5	0.5	1,536	472	57.6	22.5	10.0	3.4	5.5	0.4	0.6	4
31.7	12.8	1.7	1.1	2,745	627	15.3	23.1	22.6	17.5	11.2	5.3	2.6	1.4	0.5	0.3	0.2	215	52	17.3	36.5	21.2	11.5	3.8	3.9	5.8	5
13.5	5.0	1.2	0.5	5	1				100.0								267	68	22.1	27.9	26.5	14.7	8.8			6
21.7	12.5	1.8	0.8	695	118	3.4	12.7	16.1	15.3	18.6	21.2	6.8	4.2	0.9		0.8	11	3		66.7		33.3				7
21.3	18.4	4.9	1.5	168	20		10.0			5.0	40.0			45.0												8
22.5	18.3	8.5	2.2	14,143	2,505	6.9	12.1	16.0	21.4	18.8	11.1	6.8	3.6	2.1	1.1	0.1	180	60	48.3	36.7	11.6	1.7	1.7			9
17.6	13.9	2.5	4.2	7,683	1,347	10.3	13.7	18.9	13.7	12.6	10.0	8.5	4.9	4.2	2.1	1.1	9	4	100.0							10
17.3	13.2	2.2	0.6	2,747	458	2.0	10.7	24.2	16.6	20.3	11.6	7.6	5.0	1.1	0.9		51	17	82.3	5.9	11.8					11
19.8	18.5	2.8	0.7	336	58		10.3	27.6	27.6	17.3		5.2	1.7	10.3			374	108	14.8	45.4	38.9	0.9				12
17.2	7.2	1.0	0.8	1,322	286	16.4	21.7	23.4	23.8	9.8	2.8		1.0	0.4	0.7		49	14	21.4	50.0	14.3	14.3				13
6.1	11.2	6.3	21.2	1,406	283	2.5	22.6	38.9	13.1	8.8	7.1	3.5	2.5	0.7	0.3		1,716	413	6.3	49.6	14.5	12.6	16.2	0.5	0.3	14
33.9	20.0	4.5	0.4	5	1				100.0																	15
21.2	15.1	5.5	7.2	1,241	221	6.8	5.9	25.3	19.0	14.0	19.4	7.7	0.9	0.5	0.5		475	88		13.6	21.6	9.1	52.3	3.4		16
9.3	3.2	0.6	0.4	50	12		41.7	33.3	25.0								13	6	100.0							17
22.3	17.9	1.9	0.1	138	41	31.7	29.3	29.3	4.9	2.4	2.4						160	35	8.6	11.4		80.0				18
11.6	8.6	2.0	1.7	3,963	652	3.8	13.2	15.7	32.5	6.5	11.5	4.1	2.9	2.6	6.3	0.9	15	5	40.0	40.0	20.0					19
11.3	24.3	5.4	1.3	3,784	679	5.7	14.9	18.9	19.9	18.4	13.8	3.7	2.2	0.7	0.6	1.2	264	79	11.4	70.9	11.4	6.3				20
14.7	17.6	11.6	6.2	5,061	984	13.3	18.2	17.9	17.9	14.9	5.4	3.4	2.8	3.7	1.4	1.1	151	60	55.0	31.6	6.7	3.3	1.7	1.7		21
11.0	14.5	8.7	5.4														66	18	11.1	50.0	22.2		16.7			22
26.8	8.4	1.0	0.1	21,922	3,723	11.9	12.5	14.6	21.1	9.9	8.9	6.7	5.5	5.6	2.3	1.0	613	213	42.2	34.3	20.2	0.5	2.8			23

TABLE 72.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE STATES, BY SELECTED INDUSTRIES—PER CENT AVERAGE WEEKLY EARNINGS, AND NUMBER OF ALL WAGE-EARNERS, AND

PENNSYLVANIA.

	INDUSTRY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	TOTAL. Earnings.	Number.	MEN 16 YEARS AND OVER. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	13,205	$10.51	$11.53	$5.68	$3.46	$4,269,847	406,311	$3,926,976	340,507	1.5	1.8	2.3	2.9	4.7	7.2	9.5	13.6	17.3
2	Twenty-seven selected industries.	7,660	10.60	11.72	5.75	3.53	2,891,701	272,862	2,641,364	225,391	1.4	1.6	2.2	2.8	4.5	7.2	9.9	13.1	17.5
3	Boots and shoes	51	7.14	8.68	5.06	3.04	24,724	3,465	18,403	2,120	4.2	7.0	9.2	8.8	10.1	10.0	8.9	6.9	15.3
4	Bread and other bakery products.	2,022	9.58	10.43	4.78	3.28	67,601	7,054	63,151	6,052	1.3	1.9	2.7	5.0	5.8	7.1	8.0	9.0	20.4
5	Brick and tile	125	9.36	9.45	......	3.84	28,262	3,020	28,070	2,970	3.1	1.6	2.9	3.6	6.7	8.2	8.9	26.5	19.5
6	Carpets and rugs, other than rag.	19	9.53	10.78	7.63	3.94	23,141	2,428	17,048	1,582	0.3	0.1	1.0	3.0	6.0	5.3	13.0	8.9	22.6
7	Cars and general shop construction and repairs by steam railroad companies.	90	13.44	13.48	7.71	4.57	502,070	37,365	500,296	37,117	0.3	0.5	0.7	1.1	1.9	3.1	7.9	11.8	16.6
8	Clothing, men's	128	9.35	12.01	5.95	2.95	22,882	2,446	16,835	1,402	0.7	1.3	1.4	3.5	4.2	5.0	8.3	8.9	18.8
9	Clothing, women's	77	8.69	14.93	6.47	2.23	17,873	2,056	8,269	554	......	0.4	1.6	3.8	4.5	6.3	11.2	8.1	18.9
10	Coke	44	10.83	10.84	......	5.05	94,338	8,710	94,232	8,689	0.7	0.5	0.7	1.0	2.8	3.0	9.5	13.0	41.2
11	Cotton goods	60	8.64	11.94	6.52	3.58	63,815	7,388	38,513	3,225	1.1	1.4	3.1	3.5	6.0	7.2	9.8	11.4	13.8
12	Electrical machinery, apparatus, and supplies.	44	9.96	10.39	5.52	3.60	88,448	8,877	84,217	8,104	6.0	2.0	2.4	3.3	4.4	5.7	7.8	9.2	17.1
13	Foundry and machine shop products.	616	11.88	11.93	5.73	4.35	413,025	34,760	411,968	34,531	1.9	2.3	2.8	3.0	3.8	6.2	9.0	11.8	13.2
14	Furniture	116	10.02	10.26	5.50	3.46	35,789	3,570	35,283	3,439	1.8	2.3	3.0	3.4	8.9	11.3	10.1	13.3	15.4
15	Glass	59	13.43	14.81	6.15	4.34	194,508	14,486	184,609	12,463	0.5	0.7	2.6	2.5	3.6	5.4	5.6	12.4	17.4
16	Hosiery and knit goods	117	5.91	9.35	5.71	3.28	52,772	8,924	14,421	1,543	3.8	6.2	6.8	6.9	7.6	10.2	10.4	8.2	16.7
17	Iron and steel, blast furnaces.	29	11.87	11.89	......	5.68	125,126	10,543	124,933	10,509	0.2	0.2	0.4	0.9	1.7	3.9	3.5	12.7	34.5
18	Iron and steel, steel works and rolling mills.	61	11.83	11.91	6.68	4.71	513,972	43,440	511,508	42,961	0.6	1.2	1.3	2.5	5.0	12.0	15.1	13.9	14.8
19	Leather, tanned, curried, and finished.	121	9.14	9.51	5.48	3.97	87,012	9,522	83,754	8,806	1.9	1.5	2.2	2.6	7.2	10.6	14.9	17.5	23.2
20	Lumber and timber products.	606	9.83	9.87	5.26	3.55	72,455	7,370	72,210	7,314	1.3	0.9	1.3	1.7	6.1	10.9	12.2	25.3	12.9
21	Lumber, planing mill products, including sash, doors, and blinds.	339	12.33	12.43	5.41	3.29	46,312	3,757	46,128	3,712	0.7	1.2	2.4	2.3	4.4	5.8	4.9	15.4	13.3
22	Pottery, terra cotta, and fire clay products.	74	9.69	10.09	6.02	4.31	45,015	4,644	43,348	4,297	1.9	1.1	2.3	4.5	5.2	8.0	10.3	20.7	18.6
23	Printing and publishing, book and job.	472	10.21	11.94	5.94	3.52	39,651	3,882	33,980	2,845	1.7	4.5	5.1	5.2	5.2	5.2	4.3	5.9	11.7
24	Printing and publishing, newspapers and periodicals.	657	10.62	12.60	5.75	2.84	57,846	5,447	49,814	3,953	3.0	4.4	4.3	4.1	5.6	4.6	5.5	6.4	11.7
25	Silk and silk goods	68	5.80	8.98	5.44	2.87	63,780	10,992	22,476	2,502	4.6	7.7	11.9	8.7	7.4	6.1	8.5	7.9	10.7
26	Structural ironwork	61	10.82	10.82	......	4.33	33,754	3,121	33,741	3,118	0.7	0.6	0.7	1.3	4.5	3.3	14.8	25.5	11.3
27	Tobacco, cigars and cigarettes.	1,538	6.60	8.61	5.05	2.54	104,316	15,799	63,436	7,370	5.1	4.8	6.5	8.7	9.3	10.0	9.2	9.3	16.4
28	Woolen goods	45	7.98	9.43	6.65	4.00	29,058	3,641	20,021	2,124	0.9	1.1	1.4	3.0	12.5	11.5	12.5	20.4	20.1
29	Worsted goods	21	7.17	9.91	6.43	3.70	44,156	6,155	20,700	2,089	1.0	1.0	4.1	8.2	10.3	10.0	11.0	10.7	12.9

RHODE ISLAND.

	INDUSTRY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	1,092	$9.19	$10.73	$6.66	$3.65	$626,215	68,140	$482,791	44,978	1.0	1.6	3.1	4.7	7.9	11.5	9.9	10.2	15.1
2	Ten selected industries.	357	8.78	10.39	6.74	3.65	452,516	51,539	328,368	31,596	0.8	1.6	3.5	5.2	8.9	13.3	10.9	10.0	14.4
3	Cotton goods	42	7.19	8.42	6.44	3.61	99,572	13,854	58,778	6,978	0.5	2.4	5.8	7.6	14.4	18.2	13.2	10.9	14.5
4	Cotton small wares	14	7.59	10.49	6.37	3.22	10,659	1,405	5,056	482	0.4	2.3	1.7	3.1	11.2	12.2	11.6	12.2	16.0
5	Dyeing and finishing textiles.	26	8.41	9.36	5.98	4.34	44,634	5,307	37,105	3,966	0.9	0.5	1.9	3.9	7.6	26.4	16.8	14.0	13.0
6	Electrical machinery, apparatus, and supplies.	9	7.11	7.76	5.49	3.38	11,185	1,574	8,793	1,133	1.0	1.8	1.7	9.0	7.0	9.1	27.2	12.2	13.3
7	Foundry and machine shop products.	87	11.81	11.98	5.89	3.27	73,862	6,254	73,202	6,109	0.9	1.4	2.1	2.4	3.9	8.3	9.0	8.9	14.3
8	Hosiery and knit goods	11	6.96	10.17	6.22	3.41	8,602	1,236	2,858	281	......	3.6	3.2	8.2	7.8	13.9	9.2	8.5	16.0
9	Jewelry	112	10.62	12.80	6.31	3.50	41,390	3,899	33,475	2,616	1.8	3.6	4.1	3.9	5.3	5.0	5.3	5.0	11.1
10	Silversmithing and silverware.	4	12.68	13.42	5.66	3.00	24,371	1,922	23,409	1,744	0.1	3.0	3.2	2.2	3.4	2.5	1.2	10.1	13.4
11	Woolen goods	21	9.09	9.88	7.80	3.96	26,446	2,908	19,115	1,935	0.1	0.2	2.4	4.4	7.2	13.6	10.5	18.6	25.4
12	Worsted goods	31	8.48	10.48	7.38	3.59	111,795	13,180	66,577	6,352	1.2	0.7	4.0	6.7	12.1	11.4	9.0	6.3	13.8

SOUTH CAROLINA.

	INDUSTRY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total earnings.	Total number.	Men earnings.	Men number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	791	$4.68	$5.47	$3.84	$2.79	$151,687	32,424	$111,309	20,353	12.6	14.8	22.2	15.8	13.6	6.2	4.5	4.1	2.0
2	Six selected industries.	321	4.51	5.33	3.83	2.80	126,296	27,978	87,829	16,470	12.1	15.2	23.3	16.7	13.2	6.3	4.7	3.8	1.4
3	Cars and general shop construction and repairs by steam railroad companies.	5	10.55	10.62	3.38	......	8,933	847	8,906	839	1.2	0.4	7.3	13.4	9.5	7.4	9.2	9.7	9.3
4	Cotton goods	62	4.21	5.15	3.83	2.80	88,048	20,933	51,685	10,038	12.4	14.2	22.6	18.9	13.2	7.6	4.4	3.8	1.1
5	Fertilizers	10	5.13	5.13	......	......	7,185	1,401	7,185	1,401	3.8	21.9	20.8	18.6	19.1	3.6	9.3	1.8	0.6
6	Hosiery and knit goods	8	3.91	4.79	3.90	2.78	3,373	863	1,359	284	13.0	14.4	32.4	10.6	20.1	3.5	2.1	1.4	1.0
7	Lumber and timber products.	190	4.72	4.74	......	2.42	14,298	3,028	14,235	3,002	18.9	18.7	28.3	10.5	10.5	3.9	2.8	3.3	0.9
8	Oil, cottonseed and cake	46	4.92	4.92	......	......	4,459	906	4,459	906	8.7	18.1	30.7	14.7	14.9	4.6	2.3	3.9	0.9

[1] Less than one-tenth of 1 per cent.

DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

PENNSYLVANIA.

Men 16 years and over—continued. Per cent distribution of number by earnings—Continued. $12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	Women 16 years and over. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Children under 16 years. Earnings.	Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
18.0	15.1	3.9	2.2	$294,761	51,919	8.1	13.3	17.7	18.4	17.0	10.4	6.6	4.0	3.1	1.1	0.3	$48,110	13,885	32.7	34.3	19.4	8.9	3.4	0.9	0.4	1
17.8	15.2	4.2	2.6	214,457	37,308	8.1	12.5	17.4	18.0	16.7	10.6	7.0	4.4	3.6	1.3	0.4	35,880	10,163	32.1	32.8	19.7	9.9	4.1	0.9	0.5	2
11.6	6.3	1.2	0.5	5,592	1,105	14.8	16.4	18.5	17.5	12.7	9.3	4.5	2.2	3.5	0.6	.....	729	240	53.8	30.0	11.7	2.9	1.2	.....	0.4	3
25.4	12.3	0.9	0.2	3,712	777	8.9	25.2	23.8	19.0	9.8	5.7	3.6	1.0	1.4	0.8	0.8	738	225	33.4	43.1	8.5	9.8	4.0	0.9	0.3	4
12.4	5.4	0.6	0.6														192	50	20.0	42.0	22.0	2.0	4.0	6.0	4.0	5
25.6	10.9	2.3	1.0	5,707	748	.....	0.8	5.6	9.4	19.6	22.2	15.1	10.7	15.0	1.6	.....	386	98	11.2	35.7	32.7	8.2	7.1	5.1	.....	6
21.0	26.9	6.7	1.5	1,573	204	.....	.....	2.9	2.4	40.2	9.8	16.7	21.1	6.9	.....	.....	201	44	.....	56.8	4.5	36.4	.....	.....	2.3	7
20.3	21.8	4.6	1.2	5,885	989	6.1	13.1	13.7	20.6	16.1	13.1	7.3	5.1	3.5	1.0	0.4	162	55	52.7	30.9	14.6	1.8	.....	.....	.....	8
14.3	13.0	4.9	13.0	9,546	1,476	5.1	9.0	13.2	17.0	20.0	10.8	8.3	6.6	5.4	2.8	1.8	58	26	88.5	11.5	.....	.....	.....	.....	.....	9
21.3	5.6	0.6	0.1														106	21	.....	.....	61.9	19.1	9.5	9.5	.....	10
19.4	13.0	7.3	3.0	23,083	3,543	2.4	7.5	11.9	15.5	25.2	11.7	13.4	5.2	4.9	2.1	0.2	2,219	620	19.0	53.5	18.9	6.0	1.6	1.0	.....	11
19.8	17.0	3.9	1.4	4,159	753	9.4	7.8	10.2	18.9	26.0	23.5	3.2	0.4	0.3	0.3	.....	72	20	40.0	10.0	35.0	15.0	.....	.....	.....	12
18.2	20.8	5.0	2.0	252	44	18.2	4.6	15.9	13.6	6.8	13.6	13.6	4.6	6.8	2.3	.....	805	185	17.3	30.3	27.6	9.2	5.4	2.7	7.5	13
15.9	12.1	2.0	0.5	143	26	7.7	26.9	7.7	3.9	23.1	19.2	3.8	.....	.....	7.7	.....	363	105	29.5	32.4	26.7	8.6	2.8	.....	.....	14
14.8	13.1	8.1	13.3	3,782	615	2.6	13.3	14.5	17.6	22.6	9.7	6.2	5.7	3.1	2.9	1.8	6,117	1,408	9.6	26.5	34.4	19.4	8.4	0.8	0.9	15
11.1	6.8	3.5	1.8	33,267	5,829	8.6	13.2	15.4	16.5	15.5	14.3	7.6	5.8	2.7	0.3	0.1	5,084	1,552	47.3	25.8	13.2	7.5	4.3	1.6	0.3	16
27.5	11.4	2.5	0.6														193	34	.....	.....	11.8	85.3	.....	.....	2.9	17
13.2	11.8	4.1	4.5	701	105	1.0	1.0	19.0	22.8	31.4	12.4	5.7	3.8	.....	1.0	1.9	1,763	374	13.6	16.3	32.4	20.6	8.6	6.4	2.1	18
13.2	4.8	0.3	0.1	1,508	275	5.1	7.6	12.4	30.6	37.4	6.2	0.7	.....	.....	.....	.....	1,750	441	12.5	28.8	35.4	14.0	9.3	.....	.....	19
21.5	4.6	0.9	0.4	142	27	14.8	26.0	3.7	22.2	.....	25.9	3.7	.....	.....	3.7	.....	103	29	48.3	37.9	3.5	.....	10.3	.....	.....	20
17.8	21.1	9.9	0.8	92	17	5.9	.....	70.6	.....	5.9	5.9	.....	5.9	5.8	.....	.....	92	28	25.0	67.8	3.6	.....	3.6	.....	.....	21
17.3	7.9	1.6	0.6	602	100	.....	17.0	26.0	18.0	11.0	9.0	2.0	9.0	2.0	6.0	.....	1,065	247	8.5	25.9	27.2	26.3	9.7	2.0	0.4	22
17.8	25.4	6.5	1.5	4,959	835	4.3	11.0	16.9	14.4	17.6	16.2	13.3	2.6	1.8	1.5	0.4	712	202	17.3	51.0	22.8	6.4	1.5	0.5	0.5	23
17.9	18.0	6.7	7.8	7,487	1,302	4.6	13.3	10.0	29.9	14.0	5.9	14.8	3.1	2.6	1.6	0.2	545	192	43.8	41.7	10.9	3.1	.....	.....	0.5	24
14.0	10.8	1.3	0.4	35,866	6,594	10.2	16.3	22.3	16.3	12.7	8.8	5.1	3.5	3.6	1.0	0.2	5,438	1,896	48.6	35.4	11.5	3.1	1.3	0.1	.....	25
17.1	17.6	2.5	0.1														13	3			100.0					26
14.8	5.3	0.5	0.1	39,142	7,745	14.3	16.4	22.1	17.9	12.4	7.6	3.8	2.0	2.2	1.1	0.2	1,738	684	71.5	17.6	6.0	3.7	1.0	0.1	0.1	27
9.5	5.7	1.0	0.4	7,458	1,122	3.2	2.9	7.6	21.1	22.5	19.6	6.4	12.8	3.0	0.9	.....	1,579	395	9.6	42.6	29.6	15.2	2.5	0.5	.....	28
16.8	12.9	0.9	0.2	19,799	3,077	1.6	5.0	19.1	24.6	21.3	7.0	6.2	5.1	6.9	2.6	0.6	3,657	989	21.2	44.5	19.8	9.6	4.7	0.2	.....	29

RHODE ISLAND.

Men $12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	Women Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Children Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
17.4	13.4	2.8	1.4	$130,195	19,537	1.8	4.4	12.8	20.1	23.8	13.3	8.9	6.6	5.3	2.3	0.7	$13,229	3,625	26.6	39.8	25.6	5.2	2.6	0.1	0.1	1
16.2	11.4	2.5	1.3	112,134	16,648	1.5	4.0	12.5	20.0	24.0	13.6	9.2	6.3	5.6	2.5	0.8	12,014	3,295	27.1	40.2	25.0	5.2	2.5	.....	(1)	2
9.6	2.1	0.4	0.4	36,332	5,639	1.3	3.6	13.1	21.8	21.6	16.6	10.8	7.0	3.6	0.6	(1)	4,462	1,237	32.2	31.0	25.4	6.7	4.7	.....	.....	3
13.1	8.3	4.6	3.3	5,316	834	2.1	4.3	14.9	18.2	20.6	19.3	11.0	5.9	3.0	0.7	.....	287	89	6.7	83.2	9.0	1.1	.....	.....	.....	4
8.6	3.7	0.8	1.9	6,250	1,046	3.2	7.4	15.1	18.8	36.2	9.6	3.6	4.7	1.1	0.2	0.1	1,279	295	6.1	18.3	59.0	15.6	1.0	.....	.....	5
12.0	4.2	1.2	0.3	2,348	428	1.4	12.6	14.0	31.1	17.3	14.7	7.0	1.2	0.5	0.2	.....	44	13	23.1	30.8	46.1	.....	.....	.....	.....	6
23.8	20.5	3.5	1.0	418	71	5.6	9.9	11.3	8.5	22.5	32.4	4.2	2.8	1.4	1.4	.....	242	74	46.0	32.4	18.9	2.7	.....	.....	.....	7
12.5	12.8	3.9	0.4	5,502	884	2.9	10.0	10.1	13.8	33.4	14.6	8.8	3.7	2.4	0.3	.....	242	71	36.6	43.7	18.3	1.4	.....	.....	.....	8
22.6	19.3	8.7	4.3	7,691	1,219	4.3	8.3	14.5	18.5	19.6	12.1	10.6	4.2	5.7	1.7	0.5	224	64	28.1	40.6	20.3	9.4	.....	.....	1.6	9
18.1	32.7	7.6	2.5	911	161	.....	3.1	31.7	24.9	18.6	11.8	6.8	1.9	.....	1.2	.....	51	17	.....	100.0	.....	.....	.....	.....	.....	10
9.5	7.1	0.7	0.3	7,062	905	.....	.....	11.1	13.2	15.8	16.2	11.5	13.0	18.8	0.3	0.1	269	68	7.4	42.6	48.5	1.5	.....	.....	.....	11
21.0	11.2	1.6	1.0	40,304	5,461	0.8	1.6	10.8	20.4	26.1	9.7	7.9	6.3	7.8	6.4	2.2	4,914	1,367	28.1	50.0	18.2	2.2	1.5	.....	.....	12

SOUTH CAROLINA.

Men $12 to $15.	$15 to $20.	$20 to $25.	$25 and over.	Women Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.	Children Earnings.	Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
1.9	1.6	0.6	0.1	$24,591	6,406	27.0	24.8	24.1	16.3	5.5	1.6	0.6	0.1	(1)	(1)	(1)	$15,787	5,665	61.6	24.3	11.5	2.5	0.1	(1)	(1)	1
1.3	1.4	0.5	0.1	23,283	6,080	26.8	25.0	24.2	16.5	5.4	1.5	0.6	(1)	.....	(1)	(1)	15,184	5,428	61.4	24.6	11.6	2.3	0.1	(1)	.....	2
10.2	17.6	4.6	0.2	27	8	12.5	87.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3
0.8	0.6	0.3	0.1	21,851	5,712	26.6	25.4	24.7	16.3	4.9	1.5	0.6	(1)	.....	(1)	.....	14,512	5,183	61.7	23.9	12.0	2.3	0.1	(1)	.....	4
0.4	.....	0.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5
0.4	0.7	0.4	.....	1,405	360	29.7	17.2	15.8	20.0	14.2	1.9	0.6	.....	.....	.....	0.6	609	219	51.1	42.0	3.7	2.7	0.5	.....	.....	6
0.9	0.9	0.2	0.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	63	26	84.6	15.4	.....	.....	.....	.....	.....	7
1.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8

TABLE 72.—CLASSIFIED WEEKLY EARNINGS—TWENTY-FIVE STATES, BY SELECTED INDUSTRIES—PER CENT AVERAGE WEEKLY EARNINGS, AND NUMBER OF ALL WAGE-EARNERS, AND

TENNESSEE.

	INDUSTRY.	Number of establishments.	AVERAGE WEEKLY EARNINGS. All wage-earners.	AVERAGE WEEKLY EARNINGS. Men 16 years and over.	AVERAGE WEEKLY EARNINGS. Women 16 years and over.	AVERAGE WEEKLY EARNINGS. Children under 16 years.	TOTAL. Earnings.	TOTAL. Number.	MEN 16 YEARS AND OVER. Earnings.	MEN 16 YEARS AND OVER. Number.	Per cent distribution of number by earnings. Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	1,742	$7.51	$8.17	$4.37	$2.73	$248,431	33,092	$228,925	28,004	4.9	4.8	7.4	6.3	23.1	15.6	5.6	8.7	7.0
2	Ten selected industries.	624	7.25	8.10	4.31	2.69	124,768	17,203	112,330	13,869	4.5	4.3	8.2	5.4	24.5	16.0	5.7	8.9	6.3
3	Cars and general shop construction and repairs by steam railroad companies.	6	10.76	10.79	3.75	......	28,275	2,628	28,230	2,616	......	0.1	1.5	0.6	14.5	15.4	10.7	13.7	11.0
4	Clothing, men's	8	4.50	8.11	4.28	2.31	3,291	731	714	88	8.0	10.2	14.8	9.1	12.5	6.8	6.8	5.7	4.5
5	Cotton goods	6	4.99	6.17	4.89	3.03	7,772	1,557	4,081	661	4.9	8.3	26.0	16.7	15.7	12.3	3.3	4.2	4.5
6	Foundry and machine shop products.	47	9.32	9.36	......	3.00	13,045	1,399	13,024	1,392	2.3	3.1	5.1	3.7	28.5	8.2	7.2	9.2	3.8
7	Furniture	15	8.43	8.76	......	3.04	9,791	1,162	9,587	1,095	5.2	4.0	9.7	8.6	12.1	13.4	6.5	6.0	9.4
8	Hosiery and knit goods	6	4.01	5.55	4.10	2.35	3,812	950	1,159	209	14.8	18.2	17.2	10.5	9.6	9.1	9.6	4.8	2.9
9	Iron and steel, blast furnaces.	3	7.17	7.20	......	3.80	3,512	490	3,493	485	11.5	3.1	9.5	3.1	19.2	15.3	5.1	12.6	15.7
10	Lumber and timber products.	480	6.88	6.94	2.72	2.75	43,838	6,371	43,600	6,284	5.2	4.9	9.0	5.8	33.0	20.4	3.7	7.6	3.7
11	Lumber, planing mill products, including sash, doors, and blinds.	40	8.72	8.84	......	3.31	6,312	724	6,259	708	4.9	5.1	4.9	7.1	21.9	10.9	3.7	8.8	7.6
12	Woolen goods	13	4.30	6.60	4.06	2.50	5,120	1,191	2,183	331	14.5	13.0	14.5	6.3	12.1	3.6	2.7	11.8	10.3

VIRGINIA.

	INDUSTRY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total Earnings.	Total Number.	Men Earnings.	Men Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	1,481	$7.69	$8.47	$3.95	$3.05	$263,262	34,233	$241,781	28,544	5.8	4.3	6.3	9.0	18.8	14.7	8.1	8.0	7.2
2	Nine selected industries.	508	7.83	8.66	4.20	3.25	141,973	18,135	129,033	14,901	4.7	3.5	6.0	10.4	17.7	15.3	7.5	8.2	6.9
3	Brick and tile	21	7.31	7.58	......	2.57	4,716	645	4,626	610	4.1	5.1	5.4	10.6	21.8	19.2	7.9	13.4	5.2
4	Cars and general shop construction and repairs by steam railroad companies.	20	11.03	11.04	6.50	5.00	63,305	5,740	63,235	5,729	2.9	0.9	2.4	5.4	9.6	10.5	10.3	10.2	10.5
5	Fertilizers	14	7.36	7.36	......	......	7,684	1,044	7,684	1,044	3.9	0.8	5.3	8.7	9.4	41.4	16.2	6.9	3.6
6	Foundry and machine shop products.	34	9.97	10.04	......	2.71	7,968	799	7,949	792	0.7	3.8	3.3	3.7	16.9	20.3	6.2	8.1	6.8
7	Hosiery and knit goods	8	4.62	7.19	4.08	2.56	5,240	1,133	2,122	295	2.0	3.1	8.1	25.1	21.0	13.2	10.5	4.4	5.4
8	Lumber and timber products.	291	6.66	6.74	......	3.57	28,503	4,278	28,150	4,179	4.3	4.9	6.9	16.5	31.4	17.6	2.6	6.9	3.3
9	Lumber, planing mill products, including sash, doors, and blinds.	53	7.22	7.40	4.50	2.04	6,120	848	6,026	814	5.5	5.7	11.2	10.9	24.3	10.8	3.3	7.8	7.0
10	Tobacco, chewing and smoking, and snuff.	14	5.09	5.97	3.74	2.26	5,790	1,138	4,248	712	19.7	9.7	17.7	10.8	9.8	9.0	7.5	4.4	5.1
11	Tobacco, cigars and cigarettes.	53	5.04	6.88	4.35	3.95	12,647	2,510	4,993	726	12.4	10.1	14.6	16.5	10.6	5.9	5.6	4.7	7.6

WISCONSIN.

	INDUSTRY.	Number of establishments.	All wage-earners.	Men 16 years and over.	Women 16 years and over.	Children under 16 years.	Total Earnings.	Total Number.	Men Earnings.	Men Number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.
1	All industries	4,786	$10.12	$10.75	$5.12	$3.51	$697,137	68,865	$662,940	61,677	0.9	1.3	2.5	2.6	4.6	7.2	9.7	18.7	20.2
2	Eleven selected industries.	602	10.52	10.81	5.19	3.79	409,721	38,960	400,666	37,071	0.5	1.0	2.1	2.0	4.1	7.8	10.8	19.5	20.6
3	Agricultural implements.	32	11.27	11.35	6.20	5.24	40,740	3,615	40,479	3,567	0.4	0.7	0.9	1.8	5.7	6.9	12.5	19.0	16.8
4	Boots and shoes	17	9.13	10.87	6.36	3.97	4,995	547	3,860	355	2.8	2.8	3.4	7.3	7.3	9.9	8.2	11.0	13.5
5	Cars and general shop construction and repairs by steam railroad companies.	21	11.60	11.60	8.33	......	60,635	5,226	60,610	5,223	0.1	0.3	0.8	0.5	1.8	3.3	4.9	22.4	29.4
6	Foundry and machine shop products.	158	11.62	11.70	5.18	3.79	105,687	9,098	105,243	8,993	0.7	1.8	2.4	1.6	3.1	3.9	14.3	15.4	13.8
7	Furniture	47	8.39	8.61	4.51	3.66	29,740	3,544	29,128	3,385	1.5	0.9	5.1	2.2	11.6	21.9	15.1	16.3	12.1
8	Hosiery and knit goods	12	5.22	9.94	4.89	3.08	4,454	854	1,044	105	2.9	1.0	5.7	7.6	6.7	11.4	3.8	18.1	16.2
9	Leather, tanned, curried, and finished.	15	9.75	9.79	5.33	4.00	30,086	3,087	29,982	3,064	0.7	0.5	3.3	2.3	3.7	9.1	11.1	22.9	26.8
10	Liquors, malt	82	11.09	11.86	5.04	3.89	27,682	2,496	26,344	2,222	([1])	0.1	3.3	3.9	3.1	10.9	1.6	4.6	17.1
11	Lumber and timber products.	145	10.13	10.16	3.86	4.22	80,231	7,924	80,010	7,871	0.1	1.1	1.1	2.3	2.8	8.9	11.6	25.6	26.4
12	Lumber, planing mill products, including sash, doors, and blinds.	64	10.99	11.14	3.50	4.38	12,878	1,172	12,772	1,147	0.3	0.9	1.6	2.7	3.3	6.8	7.1	16.3	19.8
13	Paper and wood pulp	9	9.01	9.83	5.42	5.50	12,593	1,397	11,194	1,139	......	1.6	1.4	1.5	7.3	3.8	7.8	35.1	23.4

[1] Less than one-tenth of 1 per cent.

DISTRIBUTION OF WAGE-EARNERS—MEN, WOMEN, AND CHILDREN—BY GROUPS OF EARNINGS; TOTAL AND OF EACH CLASS; WITH NUMBER OF ESTABLISHMENTS: 1905—Continued.

MEN 16 YEARS AND OVER—continued. Per cent distribution of number by earnings—Continued.				WOMEN 16 YEARS AND OVER.													CHILDREN UNDER 16 YEARS.									
				Earnings.	Number.	Per cent distribution of number by earnings.											Earnings.	Number.	Per cent distribution of number by earnings.							
$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 and over.			Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 and over.	
TENNESSEE.																										
7.2	7.3	1.4	0.7	$14,965	3,425	17.5	27.5	21.2	15.4	10.3	3.6	1.9	1.5	0.8	0.2	0.1	$4,541	1,663	58.8	30.5	7.9	1.6	1.0	0.2	....	1
7.0	7.4	1.5	0.3	9,255	2,149	18.2	28.9	22.9	12.7	11.2	2.7	1.1	1.4	0.7	0.2	....	3,183	1,185	66.1	25.5	6.5	1.6	0.3	....	....	2
13.2	16.4	2.5	0.4	45	12	....	100.0	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
6.8	11.4	3.4	....	2,374	555	17.5	30.3	19.3	13.9	9.2	4.1	3.2	1.6	0.7	0.2	....	203	88	96.6	3.4	....	....	....	....	....	4
2.1	1.4	0.6	....	2,563	524	7.3	23.7	22.3	18.5	22.3	5.5	0.4	....	....	....	....	1,128	372	54.3	35.5	5.1	4.0	1.1	....	....	5
8.7	16.9	3.1	0.2	....	....	....	....	....	....	....	....	....	....	....	....	....	21	7	....	100.0	....	....	....	....	....	6
12.1	11.0	1.6	0.4	....	....	....	....	....	....	....	....	....	....	....	....	....	204	67	35.8	44.8	17.9	1.5	....	....	....	7
3.3	....	....	....	2,134	520	25.9	25.6	25.2	13.1	8.1	1.3	0.8	....	....	....	....	519	221	82.3	11.8	5.0	0.9	....	....	....	8
2.9	1.6	0.2	0.2	....	....	....	....	....	....	....	....	....	....	....	....	....	19	5	....	100.0	....	....	....	....	....	9
3.6	2.1	0.6	0.4	87	32	50.0	46.9	3.1	....	....	....	....	....	....	....	....	151	55	56.4	21.8	20.0	1.8	....	....	....	10
9.6	11.6	3.8	0.1	....	....	....	....	....	....	....	....	....	....	....	....	....	53	16	6.2	62.5	31.3	....	....	....	....	11
9.7	1.5	....	....	2,052	506	20.9	33.4	26.9	6.1	5.9	....	....	4.0	2.0	0.8	....	885	354	72.9	21.7	5.4	....	....	....	....	12
VIRGINIA.																										
8.1	7.0	1.5	1.2	$18,073	4,573	35.2	19.2	16.6	11.9	8.2	4.3	2.2	0.8	0.8	0.7	0.1	$3,408	1,116	49.5	30.7	10.3	6.4	2.1	1.0	....	1
8.6	8.7	1.6	0.9	10,744	2,558	27.5	20.8	18.6	15.1	8.9	5.2	2.4	0.7	0.4	0.3	0.1	2,196	676	43.5	30.3	12.9	8.4	3.3	1.6	....	2
3.8	1.5	0.5	1.5	....	....	....	....	....	....	....	....	....	....	....	....	....	90	35	51.4	48.6	....	....	....	....	....	3
15.0	17.7	3.1	1.5	65	10	10.0	20.0	....	....	....	....	70.0	....	....	....	....	5	1	....	....	....	100.0	....	....	....	4
2.6	1.0	0.2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
13.5	12.4	2.9	1.4	....	....	....	....	....	....	....	....	....	....	....	....	....	19	7	42.9	57.1	....	....	....	....	....	6
3.1	2.4	1.4	0.3	2,608	639	25.8	17.5	27.8	16.9	7.2	2.2	1.3	0.6	0.5	....	0.2	510	199	61.8	27.2	6.0	3.5	0.5	1.0	....	7
3.2	1.4	0.6	0.4	....	....	....	....	....	....	....	....	....	....	....	....	....	353	99	15.2	60.6	23.2	1.0	....	....	....	8
8.4	5.0	0.1	....	45	10	....	....	100.0	....	....	....	....	....	....	....	....	49	24	91.6	4.2	4.2	....	....	....	....	9
3.7	2.1	0.4	0.1	1,465	392	39.8	26.8	12.8	12.0	2.8	1.8	0.2	0.5	1.0	2.0	0.3	77	34	94.1	5.9	....	....	....	....	....	10
4.7	6.8	0.4	0.1	6,561	1,507	25.3	20.7	15.9	15.3	11.3	7.4	3.0	0.9	0.2	....	....	1,093	277	29.2	24.2	18.4	17.3	7.6	3.3	....	11
WISCONSIN.																										
17.5	11.5	2.5	0.8	$28,553	5,581	8.0	18.4	22.9	19.4	14.3	6.9	5.9	1.9	1.5	0.7	0.1	$5,644	1,607	30.2	41.2	19.5	5.0	2.6	1.1	0.4	1
16.9	11.3	2.6	0.8	7,031	1,355	6.3	15.3	17.6	29.9	17.9	7.5	3.6	1.3	0.2	0.4	....	2,024	534	14.0	47.9	26.6	7.5	3.0	0.8	0.2	2
15.2	16.4	3.0	0.7	62	10	....	....	....	....	80.0	20.0	....	....	....	....	....	199	38	2.6	7.9	47.4	15.8	15.8	7.9	2.6	3
17.7	9.9	3.1	3.1	992	156	4.5	14.7	8.3	25.6	14.8	9.0	12.8	5.8	1.3	3.2	....	143	36	19.4	38.9	30.6	5.6	5.5	....	....	4
18.5	9.0	7.5	1.5	25	[illegible]	....	....	....	....	....	....	100.0	....	....	....	....	....	....	....	....	....	....	....	....	....	5
19.2	19.5	3.4	0.9	171	33	15.1	15.2	24.2	....	27.3	6.1	12.1	....	....	....	....	273	72	2.8	62.5	27.8	5.5	1.4	....	....	6
9.7	3.0	0.5	0.1	158	35	....	28.6	22.8	48.6	....	....	....	....	....	....	....	454	124	16.9	46.0	26.6	10.5	....	....	....	7
7.6	13.3	5.7	....	2,985	611	9.0	16.4	19.5	23.3	21.4	8.5	1.6	0.3	....	....	....	425	138	29.7	63.8	6.5	....	....	....	....	8
14.3	4.6	0.6	0.1	48	9	....	....	33.3	66.7	....	....	....	....	....	....	....	56	14	21.4	28.6	21.4	28.6	....	....	....	9
32.4	22.0	0.9	0.1	1,194	237	....	19.4	8.4	67.5	4.7	....	....	....	....	....	....	144	37	....	48.6	51.4	....	....	....	....	10
13.7	4.6	0.8	1.0	27	7	....	42.9	....	57.1	....	....	....	....	....	....	....	194	46	....	43.5	34.8	13.0	8.7	....	....	11
26.7	12.6	1.2	0.7	14	4	....	50.0	50.0	....	....	....	....	....	....	....	....	92	21	....	28.6	47.6	14.3	9.5	....	....	12
9.5	6.7	1.6	0.3	1,355	250	7.2	7.6	26.4	14.4	24.0	12.4	4.8	2.8	0.4	....	....	44	8	....	12.5	37.5	25.0	12.5	12.5	....	13

APPENDIX.

CLASSIFIED WEEKLY EARNINGS, 1905, AND WAGE STATISTICS OF PRIOR CENSUSES.

STATISTICS FOR 1904 NOT STRICTLY COMPARABLE WITH STATISTICS OF PRIOR CENSUSES.

At the Tenth Census (1880) there was a special report on wages which contained statistics for the important occupations of 627 establishments. The report made a specialty of rates of wages, the most numerous quotations being for day rates; the statistics were not summarized, and no attempt was made to obtain a total for a large number of establishments or for a number of industries. While the report contains a great amount of valuable data, they are of such a character that they are not comparable with the classified earnings reported at the census of 1905, nor with the statistics of employees and wages as reported at any other census.

The inquiry used at the census of 1890 concerning specified weekly rates of wages was aimed at distributing the average number employed during the entire year as the average number employed during the week. The reports were based on rates of pay other than earnings, and the statistics include salaried officials, firm members, and clerks, but do not include pieceworkers; they are not, therefore, comparable with the statistics of the censuses of 1900 and 1905. The census of 1890, however, was the first in which an attempt was made to summarize a large number of employees by the use of the classified weekly scale.

The special report on employees and wages at the census of 1900 presents statistics of classified rates of pay, and in some cases weekly earnings, for 720 establishments in 34 of the most important industries for both 1890 and 1900. The main object of the special report of 1900 was to obtain rates of wages. Earnings were only incidental. The census of 1905 places the emphasis on earnings. Comparisons between the two are difficult and must be made with care.

The report of 1900 is composed largely of the statistics of classified "actual rates of wages" per hour and per week. Earnings in a week, although deemed of secondary importance, are also shown for a few occupations in some of the principal industries and likewise, in the "establishment comparison," for certain occupations and for all wage-earners in a limited number of establishments; while weekly earnings are compared with weekly rates of the same employees in 9 industries. It was the endeavor in each instance to make comparison of rates regulated by the same or similar conditions. Rates for the hour and week were given for the principal occupations and the results presented in much greater detail than is possible in the inquiry of 1905. The report gives separate tables for a number of representative establishments and summaries for the various industries. The conditions in different industries are so dissimilar that it was believed that a combination of the totals for all occupations, or for two or more of them, even though for industries that might be termed in some measure alike, would have little significance, and that the same would be true of a comparison of the total for the two censuses. Therefore the special report contained no general summary, and it has been necessary to prepare one in the endeavor to compare the special statistics for 1900 with the selected totals for 1905.

The inclusion of a much larger number of employees in the statistics of classified weekly earnings for 1905 than were considered in the reports for 1890 or 1900, and the differences in methods, make it impossible to prepare tables by which similar conditions can be compared or changes in rates of pay or earnings indicated with exactness. The detailed information and the limited number of reports secured for 1890 and 1900 enabled the Census Office to subject the separate returns to a careful analysis and to eliminate all questionable data. Under these circumstances a comparison of the data presented in the special reports bearing on the question of earnings for each of the three censuses should not be accepted as conclusively showing the trend of earnings. The comparisons are of value because they present all of the available census data on the subject and indicate in a general way the prevailing rates and earnings.

Comparison of rates and earnings.—The statistics of earnings in the report for 1900 are too meager to be used in the construction of a table that would be representative of the earnings of a number of industries, and the comparison of representative totals is therefore necessarily between weekly rates reported for 1900 and weekly earnings as shown for 1905. The number of wage-earners represented for 1905 is much larger and differently distributed than in 1900, and as comparatively few women and children were reported in 1900, they must be excluded from both censuses and the comparison made of the classified earnings for men. Such a comparison is necessarily very unsatisfactory, and to understand its true significance reference should be made to the method of ascertaining the rates, and to the description of the conditions affecting rates and earnings as described in the report for 1900.[1]

The limitation in the number of establishments at the census of 1900 tended to restrict the inquiry to comparisons of similar conditions, and to keep the figures from becoming affected by earnings prevailing in new establishments or in establishments engaged in different branches of the same industry. The data for the special report of 1900 were for 50-cent groups of wages; those in 1905 were for $1, $2, $3, and $5 groups of earnings. For the comparative tables, therefore, the different groups for 1890 and 1900 were combined to conform to the broader grouping of the last census.

The statistics for 1900 were collected apart from the general census and upon a special schedule by field agents selected for their experience and skill in this particular class of work; but the inquiry of 1905 was made with the regular schedule for manufactures, which was submitted to all establishments.

No attempt was made to cover the same week of the year for any establishment at the two censuses, and therefore the data are a combination of the earnings or rates reported at different seasons of the respective years. The period between the two reports for the same establishment may have ranged from three and one-half to five and one-half years. For example, if an establishment reported the first week in July, 1899, for the census of 1900 and the last week of December, 1904, for the census of 1905, the interval would be about five and one-half years.

There are 34 industries for which statistics of rates were shown for men in 1900, and these are compared in the following tables with the classified earnings for men in the same or allied industries, as reported at the census of 1905:

[1] Twelfth Census, Employees and Wages, pages xxix and xxx.

TABLE 1.—*Summary of statistics for classified weekly earnings, 1905, and weekly rates, 1900, for men in thirty-four industries.*

EARNINGS AND RATES.	NUMBER.		ABSOLUTE PERCENTAGE.		CUMULATIVE PERCENTAGE.	
	1905 earnings.	1900 rates.	1905 earnings.	1900 rates.	1905 earnings.	1900 rates.
Total	1,943,238	182,206	100.0	100.0	....	....
Less than $3	40,173	735	2.1	0.4	100.0	100.0
$3 to $4	41,060	3,177	2.1	1.8	97.9	99.6
$4 to $5	63,555	5,110	3.3	2.8	95.8	97.8
$5 to $6	74,271	4,587	3.8	2.5	92.5	95.0
$6 to $7	121,286	9,190	6.2	5.0	88.7	92.5
$7 to $8	149,118	18,061	7.7	9.9	82.5	87.5
$8 to $9	158,441	14,749	8.1	8.1	74.8	77.6
$9 to $10	257,080	26,548	13.2	14.6	66.7	69.5
$10 to $12	304,458	28,531	15.7	15.7	53.5	54.9
$12 to $15	330,558	35,932	17.0	19.7	37.8	39.2
$15 to $20	286,095	26,466	14.7	14.5	20.8	19.5
$20 to $25	77,159	5,171	4.0	2.8	6.1	5.0
$25 and over	39,984	3,949	2.1	2.2	2.1	2.2

If the rates of pay were the same, the differences between the rates and earnings would be due entirely to departure from normal working time. "When a considerable number of persons are considered, working under normal conditions—the conditions represented by the pay roll returns—their rates will be somewhat higher than their earnings, but the difference will not be marked."[1] A comparison of both rates and earnings for a number of persons for whom exact working time was reported at the Twelfth Census developed very little difference in the numbers at the respective wage groups, but such a degree of harmony could not be expected from a comparison of the statistics of rates for the 182,206 employees represented in the special report of the Twelfth Census with those for earnings in the much larger number of employees and greater diversity of industry reported at the census of 1905.

[1] Twelfth Census, Employees and Wages, page xxx.

The slightly larger proportions in the higher groups indicated by the cumulative percentages for 1900 is due not only to the fact that they are based on rates, but also to the fact that they represent a comparatively few carefully selected high-class establishments in permanently established industries chosen for the purpose of making effective comparisons between 1890 and 1900, rather than as representing absolute conditions in 1900. No conclusions should be drawn from the figures unless proper allowance is made for the conditions surrounding the two reports. The absolute percentages for earnings and rates are the same in two of the thirteen groups shown in the above table, and there is a variation of less than 1 per cent in four groups. The widest variation, 2.7 per cent, is shown for the group of $12 to $15; the number in this group for the rates of 1900 formed 19.7 per cent of the total, as compared with 17 per cent of the total earnings for 1905. The median was in the group $10 to $12 at both censuses, but the cumulative percentages show slightly larger proportions in the higher groups for the rates of 1900 than for the earnings of 1905. On the whole, there is a striking agreement in the percentages.

Table 2 shows the totals for each industry summarized in Table 1.

TABLE 2.—CLASSIFIED WEEKLY EARNINGS, 1905, AND WEEKLY RATES, 1900 TOTAL, FOR MEN—ABSOLUTE NUMBER IN EACH GROUP BY INDUSTRIES: 1905 AND 1900.

INDUSTRY.	Year.	MEN 16 YEARS AND OVER.													
		Total number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.
Total	1905	1,943,238	40,173	41,060	63,555	74,271	121,286	149,118	158,441	257,080	304,458	330,558	286,095	77,159	39,984
	1900	182,206	735	3,177	5,110	4,587	9,190	18,061	14,749	26,548	28,531	35,932	26,466	5,171	3,949
Agricultural implements	1905	30,679	419	459	757	909	1,596	2,312	3,414	4,887	4,982	5,638	4,197	907	202
	1900	14,807	4	70	212	238	640	699	758	4,109	2,581	3,692	1,661	107	36
Bakeries	1905	48,230	382	740	1,014	1,615	2,396	2,278	2,760	3,622	7,834	13,323	10,528	1,416	322
	1900	1,550		15	59	52	69	77	81	146	220	559	217	36	19
Breweries	1905	27,741	249	218	346	435	527	873	480	1,180	2,553	6,584	11,634	2,159	503
	1900	4,660		74	64	6	124	121	32	148	537	1,402	1,978	119	55
Brickyards	1905	40,881	1,240	796	1,242	1,237	2,746	3,497	3,728	9,220	7,384	6,181	2,677	615	318
	1900	239		5			6	22	6	68	55	63	7	5	2
Candy	1905	7,595	109	255	400	482	846	773	595	694	1,005	1,121	924	265	126
	1900	572	18	40	72	66	42	47	27	86	33	90	35	7	9
Car and railroad shops	1905	232,405	3,509	2,092	3,409	4,322	8,205	11,704	20,272	33,429	41,809	43,988	42,778	13,161	3,727
	1900	11,435	5	24	202	211	308	1,405	968	1,819	1,492	2,242	2,532	175	52
Carpet mills	1905	5,525	69	48	185	329	438	788	686	655	862	878	462	81	44
	1900	846	1	9	46	70	50	76	83	209	81	125	71	14	11
Cereal mills	1905	3,782	66	73	85	149	276	290	287	545	840	725	344	74	28
	1900	926			4	4	22	48	221	317	120	147	34	6	3
Chemicals	1905	34,027	1,262	1,079	1,292	2,431	2,977	2,885	3,036	4,931	6,031	4,692	2,579	528	304
	1900	5,548	3	39	54	48	107	510	839	1,216	1,337	889	389	96	21
Cigars	1905	46,680	1,244	1,735	1,925	2,353	2,671	2,493	2,951	3,470	7,493	10,248	7,799	1,654	644
	1900	1,196	3	38	51	40	58	85	84	113	168	246	225	59	26
Clothing	1905	32,300	250	575	797	1,138	1,530	1,847	2,225	2,628	4,879	5,996	6,097	2,988	1,350
	1900	1,360	46	75	65	60	54	92	66	104	169	222	273	97	37
Collars and cuffs	1905	1,078	36	54	82	87	98	92	64	87	147	135	127	33	36
	1900	250		25	21	16	29	24	22	10	23	38	23	8	11
Cotton mills	1905	95,976	3,937	5,175	9,858	10,886	14,311	12,936	9,269	8,550	9,660	7,157	2,947	903	387
	1900	5,038	67	300	615	552	875	629	345	404	543	486	148	48	26
Distilleries	1905	5,175	130	132	256	177	561	400	185	838	871	929	517	110	60
	1900	191				2	3	11		42	68	42	13	3	7
Dyeing and finishing textiles	1905	15,996	143	240	425	752	1,391	3,367	2,096	2,103	2,719	1,584	682	175	319
	1900	2,342		9	139	127	435	569	268	286	157	174	58	33	87
Flour mills	1905	30,684	380	539	923	966	3,211	3,007	1,956	5,455	5,484	5,079	2,877	559	248
	1900	1,777		2	3	2	34	16	38	246	437	538	381	46	34
Foundries and metal working	1905	367,778	5,098	6,630	9,224	10,425	15,943	22,852	29,332	47,106	56,069	68,497	72,755	17,215	6,632
	1900	43,343	233	768	1,176	879	1,936	4,616	3,725	6,530	5,659	8,389	7,392	1,486	494

TABLE 2.—CLASSIFIED WEEKLY EARNINGS, 1905, AND WEEKLY RATES, 1900 TOTAL, FOR MEN—ABSOLUTE NUMBER IN EACH GROUP BY INDUSTRIES: 1905 AND 1900—Continued.

INDUSTRY.	Year.	MEN 16 YEARS AND OVER. Total number.	Less than $3.	$3 to $4.	$4 to $5.	$5 to $6.	$6 to $7.	$7 to $8.	$8 to $9.	$9 to $10.	$10 to $12.	$12 to $15.	$15 to $20.	$20 to $25.	$25 and over.
Furniture	1905	53,715	924	1,207	2,103	2,414	3,983	5,614	5,279	7,378	8,145	9,362	5,959	1,063	284
	1900	4,316	41	153	172	180	306	568	414	531	630	811	393	104	13
Glass	1905	31,510	562	772	1,469	1,657	1,696	1,828	1,968	3,357	4,026	3,630	3,448	2,378	4,719
	1900	4,479	2	310	202	337	256	361	223	436	526	596	471	369	390
Iron and steel mills	1905	141,170	1,638	1,547	1,970	2,754	4,983	10,470	15,802	18,180	28,398	25,057	17,630	6,015	6,726
	1900	26,183	15	97	243	356	892	3,382	2,437	2,381	5,223	5,633	3,131	904	1,489
Knitting mills	1905	11,558	326	414	683	782	1,447	1,608	1,417	1,288	1,544	1,072	669	205	103
	1900	458		17	20	30	79	70	42	58	27	50	38	18	9
Lumber and planing mills	1905	225,785	8,935	6,185	10,264	9,765	22,742	23,497	15,694	40,173	28,511	30,586	21,786	5,598	2,049
	1900	2,798	8	1	46	17	178	239	528	600	452	391	244	64	30
Paper mills	1905	31,735	666	376	499	579	1,173	2,232	3,018	7,811	6,328	4,914	3,103	796	240
	1900	1,935			23	32	90	227	317	645	204	205	161	22	9
Pianos	1905	17,679	160	285	505	700	828	891	1,104	1,563	2,493	3,839	3,675	1,080	556
	1900	1,781	100	94	62	51	56	91	116	144	249	448	297	42	31
Potteries	1905	21,838	426	262	473	713	997	1,849	2,291	4,682	3,751	2,963	2,126	765	540
	1900	634	1	6	10	13	41	71	18	81	47	89	154	71	32
Printing	1905	88,987	2,579	3,210	3,640	3,816	5,009	4,358	4,301	5,810	9,685	13,480	18,040	8,392	6,667
	1900	3,828	8	88	72	86	142	137	139	145	319	511	927	544	710
Rubber	1905	22,092	173	224	531	659	1,006	1,410	1,802	3,785	4,127	4,217	3,465	561	132
	1900	1,386	3	59	57	35	58	170	112	400	210	166	97	13	6
Shipyards	1905	30,990	797	674	983	1,298	1,363	1,937	1,758	2,881	4,722	5,753	6,944	1,413	467
	1900	10,873	50	233	123	88	423	1,039	573	695	1,474	3,313	2,524	270	68
Shoes	1905	59,142	1,004	1,446	2,094	2,594	3,557	3,900	4,077	5,319	8,609	11,565	10,811	3,046	1,120
	1900	3,026	41	180	142	141	207	161	142	221	388	647	642	68	46
Slaughtering	1905	33,639	606	394	515	736	1,205	1,648	2,378	4,473	8,750	7,454	4,390	752	338
	1900	8,701		20	264	33	233	299	11	2,059	3,165	1,579	806	105	67
Tanneries	1905	38,293	519	465	1,024	1,350	2,623	3,826	4,524	6,840	8,317	5,510	2,644	468	183
	1900	6,010		60	132	208	342	677	1,368	1,238	853	807	257	47	21
Tobacco	1905	8,703	664	978	1,168	1,160	1,140	877	626	632	632	481	270	56	19
	1900	1,455	76	222	338	202	215	113	64	81	66	26	35	12	5
Wagons and carriages	1905	40,981	641	691	1,080	1,224	2,300	3,116	2,756	6,325	6,687	8,839	6,206	898	218
	1900	3,240	3	52	118	89	228	409	243	416	455	587	493	103	44
Woolen mills	1905	58,889	1,030	1,090	2,334	3,377	5,511	7,663	6,310	7,183	9,111	9,081	5,005	830	364
	1900	5,023	7	92	303	316	652	1,000	439	504	563	729	299	70	49

According to the special report, 720 pay rolls were utilized in compiling the statistics for the census of 1900. Classified according to the number of employees in the establishments reporting, 260 of these pay rolls represented establishments that employed less than 100 wage-earners; 336 that employed 100 to 499; 74 that employed 500 to 999; and 50 that employed 1,000 and over. The establishments were distributed among 34 industries.[1] While some information was obtained from nearly all the 720 pay rolls, it is evident that because of defective data or for other reasons a few were excluded from the report. In some instances the pay rolls of different departments of the same establishment were considered as pay rolls of separate establishments. After making the eliminations and consolidations necessary for comparison with the reports for the census of 1905, it is found that there are 697 establishments to be considered. The regular Census classification of industries was not followed in distributing these establishments among the 34 industries shown in the special report of 1900, and in order to present statistics for similar industries at the two censuses it is necessary to combine the data for a number of the classes shown separately in the reports for 1905. These combinations are given in the following statement, the classification used in the special report of 1900 being accepted as the standard:

[1] Twelfth Census, Employees and Wages, page xv.

Industry classifications adjusted: 1900 and 1905.

INDUSTRY AND NUMBER OF ESTABLISHMENTS AS GIVEN IN SPECIAL REPORT OF 1900. Industry.	Number.		REGULAR CENSUS CLASSIFICATION OF INDUSTRY AND NUMBER OF ESTABLISHMENTS FOR 1905. CONSOLIDATIONS AND ADJUSTMENTS TO COMPARE WITH INDUSTRY OF 1900. Industry.	Number.
Agricultural implements		15	Agricultural implements (Total for 1900 includes 1 establishment classed as "foundry and machine shop products," the corresponding figures for which are included in the total for "foundries and metal working" for 1905 in Table 2.)	362
Agricultural implements	14			
Foundry and machine shop products	1			
Bakeries		29	Bread and other bakery products	13,493
Breweries		33	Liquors, malt	918
Brickyards		3	Brick and tile (Total for 1900 includes 1 establishment classed as "pottery, terra cotta, and fire clay products," the corresponding figures for which are included in the total for "potteries" for 1905 in Table 2.)	2,053
Brick and tile	2			
Pottery, terra cotta, and fire clay products	1			

Industry classifications adjusted: 1900 and 1905—Continued.

INDUSTRY AND NUMBER OF ESTABLISHMENTS AS GIVEN IN SPECIAL REPORT OF 1900.		REGULAR CENSUS CLASSIFICATION OF INDUSTRY AND NUMBER OF ESTABLISHMENTS FOR 1905. CONSOLIDATIONS AND ADJUSTMENTS TO COMPARE WITH INDUSTRY OF 1900.	
Industry.	Number.	Industry.	Number.
Candy	9	Confectionery	816
Car and railroad shops	12	Cars and general shop construction and repairs by steam railroad companies	713
Cars and general shop construction and repairs by steam railroad companies	6	Cars, steam railroad, not including operations of railroad companies	46
Cars, steam railroad, not including operations of railroad companies	4	Cars, street railroad, not including operations of railroad companies	8
Cars, street railroad, not including operations of railroad companies	1	(Total for 1900 includes 1 establishment classed as "locomotives," the corresponding figures for which are included in the total for "foundries and metal working" for 1905 in Table 2.)	
Locomotives	1		
Carpet mills	4	Carpets and rugs, other than rag	36
Cereal mills	4	Food preparations	445
Chemicals	13	Chemicals	155
Chemicals	3	Druggists' preparations	124
Druggists' preparations	1	Explosives	28
Explosives	2	Fertilizers	200
Fertilizers	1	Paints	304
Paints	5	Varnishes	129
Varnishes	1		
Cigars	27	Tobacco, cigars and cigarettes	9,033
Tobacco, cigars and cigarettes	26	(Total for 1900 includes 1 establishment classed as "tobacco, chewing and smoking, and snuff," the corresponding figures for which are included in the total for "tobacco" for 1905 in Table 2.)	
Tobacco, chewing and smoking, and snuff	1		
Clothing	27	Clothing, men s	1,697
Clothing, men's	22	Clothing, women's	1,072
Clothing, women's	5		
Collars and cuffs	4	Collars and cuffs	9
Cotton mills	18	Cotton goods	525
Cotton goods	16	Cotton small wares	40
Cotton small wares	1	(Total for 1900 includes 1 establishment classed as "dyeing and finishing textiles," the corresponding figures for which are included in the total for "dyeing and finishing textiles" for 1905 in Table 2.)	
Dyeing and finishing textiles	1		
Distilleries	3	Liquors, distilled	575
Dyeing and finishing textiles	6	Dyeing and finishing textiles	179
Dyeing and finishing textiles	4	(Total for 1900 includes 2 establishments classed as "cotton goods," the corresponding figures for which are included in the total for "cotton goods" for 1905 in Table 2.)	
Cotton goods	2		
Flour mills	32	Flour and grist mill products	7,382
Foundries and metal working	112	Foundry and machine shop products	5,359
Foundry and machine shop products	77	Bicycles and tricycles	69
Agricultural implements	1	Cutlery and edge tools	129
Bicycles and tricycles	1	Firearms	20
Bridges	1	Hardware	237
Cars and general shop construction and repairs by steam railroad companies	2	Locomotives	11
Cutlery and edge tools	1	Screws, wood	5
Firearms	1	Sewing machines and attachments	27
Hardware	3	Steam fittings and heating apparatus	124
Iron and steel, blast furnaces	1	Stoves and furnaces, not including gas and oil stoves	206
Iron and steel, steel works and rolling mills	3	Structural ironwork (representing "bridges" for 1900)	418
Locomotives	4	Watches	7
Screws, wood	1	Wirework, including wire rope and cable	374
Sewing machines and attachments	5	(Total for 1900 includes 1 establishment classed as "agricultural implements," 2 establishments classed as "cars and general shop construction and repairs by steam railroad companies," 1 establishment classed as "iron and steel, blast furnaces," and 3 establishments classed as "iron and steel, steel works and rolling mills," the corresponding figures for which in 1905 are included in the totals for these industries in Table 2.)	
Steam fittings and heating apparatus	1		
Foundries and metal working—Continued.			
Stoves and furnaces, not including gas and oil stoves	6		
Watches	1		
Wirework, including wire rope and cable	3		
Furniture	24	Furniture	1,257
Glass	20	Glass	171
Iron and steel	24	Iron and steel, blast furnaces	82
Iron and steel, blast furnaces	7	Iron and steel, steel works and rolling mills	192
Iron and steel, steel works and rolling mills	17		
Knitting mills	11	Hosiery and knit goods	416
Lumber and planing mills	24	Lumber and timber products	8,394
Lumber and timber products	15	Lumber, planing mill products, including sash, doors, and blinds	2,866
Lumber, planing mill products, including sash, doors, and blinds	9		
Paper mills (Statistics for 1900 did not include the manufacture of wood pulp.)	17	Paper and wood pulp	381
Pianos	11	Musical instruments, organs	57
Musical instruments, organs	3	Musical instruments, pianos	125
Musical instruments, pianos	7	Musical instruments, piano and organ materials	62
Musical instruments, piano and organ materials	1		
Potteries	6	Pottery, terra cotta, and fire clay products	420
Printing	45	Printing and publishing, book and job	4,802
Printing and publishing, book and job	15	Printing and publishing, newspapers and periodicals	10,860
Printing and publishing, newspapers and periodicals	30		
Rubber	4	Belting and hose, rubber	9
Belting and hose, rubber	1	Boots and shoes, rubber	19
Boots and shoes, rubber	2	Rubber and elastic goods	133
Rubber and elastic goods	1		
Shipbuilding	20	Shipbuilding, iron and steel	28
Shipbuilding, iron and steel	11	Shipbuilding, wooden, including boat building	518
Shipbuilding, wooden, including boat building	9		
Shoes	26	Boots and shoes	745
Slaughtering	6	Slaughtering and meat packing, wholesale	348
Slaughtering and meat packing, wholesale	5	Slaughtering, wholesale, not including meat packing	209
Slaughtering, wholesale, not including meat packing	1		
Tanneries	37	Leather, tanned, curried, and finished	621
Tobacco	13	Tobacco, chewing and smoking, and snuff	229
Wagons and carriages	31	Carriages and wagons	3,433
Woolen mills	27	Silk and silk goods	205
Silk and silk goods	1	Wool scouring	11
Wool scouring	2	Woolen goods	366
Woolen goods	14	Worsted goods	108
Worsted goods	10		

Comparison of earnings by industries.—The classified weekly earnings are shown in the report for 1900 for each of 15 industries, and it is possible to compare the data for 11 of them with corresponding totals for the census of 1905.

TABLE 3.—AGRICULTURAL IMPLEMENTS—NUMBER OF MEN BY CLASSIFIED WEEKLY EARNINGS, WITH CUMULATIVE PERCENTAGES, AND ESTIMATED DISTRIBUTION OF AVERAGE NUMBER IN ALL ESTABLISHMENTS: 1890 TO 1905.[1]

[Each cumulative percentage shows the proportion of total number of persons receiving earnings as great as, or greater than, the lowest earnings of the given group.]

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER.								
	Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	30,679	9,633	3,719				46,631	46,174	38,327
Less than $3	419	331	138	100.0	100.0	100.0	653	1,570	1,418
$3 to $4	459	178	92	98.6	96.6	96.3	700	831	958
$4 to $5	757	291	120	97.1	94.8	93.8	1,119	1,385	1,226
$5 to $6	909	335	129	94.7	91.8	90.6	1,399	1,616	1,341
$6 to $7	1,596	468	203	91.7	88.3	87.1	2,425	2,263	2,108
$7 to $8	2,312	604	256	86.5	83.4	81.6	3,497	2,909	2,645
$8 to $9	3,414	704	265	79.0	77.1	74.7	5,176	3,371	2,721
$9 to $10	4,887	1,171	506	67.9	69.8	67.6	7,414	5,633	5,213
$10 to $12	4,982	1,980	609	52.0	57.6	54.0	7,554	9,512	6,286
$12 to $15	5,638	2,399	721	35.8	37.0	37.6	8,580	11,497	7,435
$15 to $20	4,197	1,089	533	17.4	12.1	18.2	6,389	5,217	5,481
$20 to $25	907	62	102	3.7	0.8	3.9	1,399	277	1,035
$25 and over	202	21	45	0.7	0.2	1.2	326	93	460

[1] For the calendar year 1904.

TABLE 4.—CARPET MILLS—NUMBER OF MEN AND WOMEN BY CLASSIFIED WEEKLY EARNINGS, WITH CUMULATIVE PERCENTAGES, AND ESTIMATED DISTRIBUTION OF AVERAGE NUMBER IN ALL ESTABLISHMENTS: 1890 TO 1905.[1]

[Middle states only.]

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER.									WOMEN 16 YEARS AND OVER.								
	Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.			Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	3,025	758	616				13,545	11,278	10,546	2,112	672	788				11,040	9,899	9,616
Less than $3	20	9	7	100.0	100.0	100.0	95	135	116	13	2	7	100.0	100.0	100.0	66	30	87
$3 to $4	15	7	9	99.3	98.8	98.9	68	102	158	23	6	21	99.4	99.7	99.1	122	89	260
$4 to $5	61	7	21	98.8	97.9	97.4	271	102	359	164	8	32	98.3	98.8	96.4	861	119	304
$5 to $6	186	31	33	96.8	97.0	94.0	826	462	570	386	45	89	90.5	97.6	92.3	2,020	663	1,087
$6 to $7	193	24	35	90.7	92.9	88.6	867	361	601	197	70	143	72.2	90.9	81.0	1,027	1,030	1,740
$7 to $8	517	37	50	84.3	89.7	82.9	2,316	553	854	379	132	97	62.9	80.5	62.9	1,976	1,940	1,183
$8 to $9	365	89	61	67.2	84.8	74.8	1,639	1,320	1,044	293	176	105	45.0	60.9	50.6	1,535	2,594	1,279
$9 to $10	393	96	90	55.1	73.1	64.9	1,761	1,432	1,540	341	104	85	31.1	34.7	37.3	1,777	1,534	1,038
$10 to $12	506	258	174	42.1	60.4	50.3	2,262	3,834	2,974	278	110	139	15.0	19.2	26.5	1,457	1,623	1,692
$12 to $15	515	152	104	25.4	26.4	22.1	2,303	2,267	1,782	37	19	70	1.8	2.8	8.9	199	277	856
$15 to $20	197	47	24	8.4	6.3	5.2	880	699	411	[2] 1			(3)					
$20 to $25	39	1	7	1.9	0.1	1.3	176	11	116									
$25 and over	18		1	0.6		0.2	81		21									

[1] For the calendar year 1904. [2] $15 and over. [3] Less than one-tenth of 1 per cent.

TABLE 5.—CARS AND RAILROAD SHOPS—NUMBER OF MEN BY CLASSIFIED WEEKLY EARNINGS, WITH CUMULATIVE PERCENTAGES, AND ESTIMATED DISTRIBUTION OF AVERAGE NUMBER IN ALL ESTABLISHMENTS: 1890 TO 1905.[1]

[Cars and general shop construction and repairs by steam railroad companies; cars, steam railroad, not including operations of railroad companies; cars, street railroad, not including operations of railroad companies—Middle states only.]

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER.								
	Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	69,428	710	493	......	......	......	79,157	62,531	49,569
Less than $3	841	4	......	100.0	100.0	100.0	950	375	....
$3 to $4	666	6	......	98.8	99.4	100.0	792	563	....
$4 to $5	784	1	......	97.8	98.5	100.0	871	63	....
$5 to $6	985	4	2	96.7	98.4	100.0	1,108	375	198
$6 to $7	1,705	6	......	95.3	97.8	99.6	1,979	563	....
$7 to $8	2,956	5	4	92.8	96.9	99.6	3,404	438	397
$8 to $9	6,841	[illegible]	15	88.5	96.2	98.8	7,757	500	1,487
$9 to $10	9,285	32	36	78.7	95.4	95.8	10,607	2,814	3,618
$10 to $12	12,564	79	62	65.3	90.9	88.5	14,327	6,941	6,246
$12 to $15	13,469	241	156	47.2	79.8	75.9	15,357	21,198	15,664
$15 to $20	14,815	272	202	27.8	45.9	44.3	16,860	23,949	20,323
$20 to $25	3,615	53	16	6.5	7.6	3.3	4,116	4,690	1,636
$25 and over	902	1	......	1.3	0.1	......	1,029	62	....

[1] For the calendar year 1904.

TABLE 6.—CIGARS—NUMBER OF MEN AND WOMEN BY CLASSIFIED WEEKLY EARNINGS, WITH CUMULATIVE PERCENTAGES, AND ESTIMATED DISTRIBUTION OF AVERAGE NUMBER IN ALL ESTABLISHMENTS: 1890 TO 1905.[1]

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER.									WOMEN 16 YEARS AND OVER.								
	Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.			Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	46 680	1,762	1,130	......	......	......	72,970	62,094	59,452	34,374	1,490	890	......	......	......	57,174	37,740	24,214
Less than $3	1,244	28	53	100.0	100.0	100.0	1,970	994	2,794	3,779	87	96	100.0	100.0	100.0	6,289	2,189	2,615
$3 to $4	1,735	33	37	97.3	98.4	95.3	2,700	1,180	1,962	4,358	150	116	89.0	94.2	89.2	7,261	3,812	3,148
$4 to $5	1,925	44	44	93.6	96.5	92.0	2,992	1,552	2,319	5,576	254	155	76.3	84.1	76.2	9,262	6,416	4,213
$5 to $6	2,353	34	60	89.5	94.0	88.1	3,649	1,180	3,151	5,528	302	157	60.1	67.1	58.8	9,205	7,661	4,262
$6 to $7	2,671	65	82	84.5	92.1	82.8	4,159	2,298	4,340	4,801	226	111	44.0	46.8	41.2	8,004	5,737	3,027
$7 to $8	2,493	101	86	78.8	88.4	75.5	3,867	3,539	4,518	3,799	152	93	30.0	31.6	28.7	6,346	3,849	2,542
$8 to $9	2,951	111	84	73.5	82.7	67.9	4,597	3,912	4,399	2,178	112	49	18.9	21.4	18.2	3,602	2,831	1,332
$9 to $10	3,470	135	87	67.2	76.4	60.5	5,400	4,781	4,578	1,490	73	44	12.6	13.9	12.7	2,459	1,849	1,186
$10 to $12	7,493	214	136	59.8	68.7	52.8	11,748	7,513	7,134	1,575	91	41	8.3	9.0	7.8	2,630	2,302	1,114
$12 to $15	10,248	335	204	43.7	56.6	40.8	16,053	11,798	10,761	941	38	23	3.7	2.9	3.2	1,544	981	630
$15 to $20	7,799	437	185	21.7	37.6	22.7	12,186	15,399	9,750	[2] 349	5	5	1.0	0.3	0.6	[2] 572	113	145
$20 to $25	1,654	151	48	5.0	12.8	6.3	2,627	5,340	2,497	......	......	......	......	......	......	......	......	......
$25 and over	644	74	24	1.4	4.2	2.1	1,022	2,608	1,249	......	......	......	......	......	......	......	......	......

[1] For the calendar year 1904.

[2] $15 and over.

TABLE 7.—CLOTHING—NUMBER OF WOMEN BY CLASSIFIED WEEKLY EARNINGS, WITH CUMULATIVE PERCENTAGES, AND ESTIMATED DISTRIBUTION OF AVERAGE NUMBER IN ALL ESTABLISHMENTS: 1890 TO 1905.[1]

[Clothing, men's; clothing, women's.]

WEEKLY EARNINGS.	WOMEN 16 YEARS AND OVER.								
	Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	54,220	1,240	986	......	......	......	147,710	126,712	101,534
Less than $3	3,894	93	121	100.0	100.0	100.0	10,635	9,503	12,489
$3 to $4	5,082	147	138	92.8	95.5	87.7	13,885	15,079	14,215
$4 to $5	6,793	200	152	83.4	80.6	73.7	18,464	20,401	15,636
$5 to $6	8,434	239	172	70.9	64.5	58.3	23,043	24,455	17,667
$6 to $7	9,072	209	155	55.3	45.2	40.9	24,667	21,414	15,941
$7 to $8	6,514	143	93	38.6	28.3	25.2	17,725	14,572	9,544
$8 to $9	5,030	91	68	26.6	16.8	15.8	13,737	9,250	7,006
$9 to $10	3,591	57	33	17.3	9.5	8.9	9,749	5,829	3,452
$10 to $12	3,368	49	36	10.7	4.9	5.5	9,158	5,069	3,757
$12 to $15	1,671	11	16	4.5	0.9	1.8	4,579	1,140	1,624
$15 and over	771	1	[illegible]	1.4	(2)	0.2	2,068	....	203

[1] For the calendar year 1904.

[2] Less than one-tenth of 1 per cent.

TABLE 8.—COLLARS AND CUFFS—NUMBER OF MEN, WOMEN, AND CHILDREN BY CLASSIFIED WEEKLY EARNINGS, WITH CUMULATIVE PERCENTAGES, AND ESTIMATED DISTRIBUTION OF AVERAGE NUMBER IN ALL ESTABLISHMENTS: 1890 TO 1905.[1]

[New York state only.]

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER.									WOMEN 16 YEARS AND OVER.		
	Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.			Number.		
	1905	1900	1890	1905	1900	1890	1905 [2]	1900 [2]	1890 [2]	1905	1900	1890
Total	1,069	400	60				1,449			5,330	3,690	2,215
Less than $3	35	2		100.0	100.0	100.0	48			303	119	55
$3 to $4	54	2	1	96.7	99.5	100.0	72			511	228	117
$4 to $5	80	9	2	91.7	99.0	98.3	109			460	319	227
$5 to $6	86	24	6	84.2	96.8	95.0	116			476	379	354
$6 to $7	97	25	5	76.2	90.8	85.0	132			577	433	294
$7 to $8	92	19	8	67.1	84.6	76.7	125			580	436	304
$8 to $9	64	17	1	58.5	79.8	63.4	87			597	419	215
$9 to $10	86	25	1	52.5	75.6	61.7	116			476	380	175
$10 to $12	145	87	3	44.5	69.3	60.0	197			646	506	271
$12 to $15	134	72	6	30.9	47.5	55.0	181			486	350	151
$15 to $20	127	52	9	18.4	29.5	45.0	172			[3] 218	[3] 121	[3] 52
$20 to $25	33	44	10	6.5	16.5	30.0	45					
$25 and over	36	22	8	3.4	5.5	13.3	49					

WEEKLY EARNINGS.	WOMEN 16 YEARS AND OVER—continued.						CHILDREN UNDER 16 YEARS.								
	Cumulative percentage.			Estimated distribution of average number in all establishments.			Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.		
	1905	1900	1890	1905	1900 [2]	1890 [2]	1905	1900	1890	1905	1900	1890	1905	1900 [2]	1890 [2]
Total				8,843			99	30	8				76		
Less than $3	100.0	100.0	100.0	504			6	24	7	100.0	100.0	100.0	5		
$3 to $4	94.3	96.8	97.5	849			64	6	1	93.9	20.0	12.5	49		
$4 to $5	84.7	90.6	92.2	769			24			29.2			18		
$5 to $6	76.0	82.0	81.9	787			4			5.0			3		
$6 to $7	67.1	71.7	65.9	955			1			1.0			1		
$7 to $8	56.3	60.0	52.6	964											
$8 to $9	45.4	48.2	38.9	990											
$9 to $10	34.2	36.8	29.2	787											
$10 to $12	25.3	26.5	21.3	1,070											
$12 to $15	13.2	12.8	9.1	805											
$15 to $20	4.1	3.3	2.3	[3] 363											

[1] For the calendar year 1904.

[2] No separate general census classification for 1900 and 1890.

[3] $15 and over.

TABLE 9.—COTTON MILLS—NUMBER OF MEN AND WOMEN BY CLASSIFIED WEEKLY EARNINGS, WITH CUMULATIVE PERCENTAGES, AND ESTIMATED DISTRIBUTION OF AVERAGE NUMBER IN ALL ESTABLISHMENTS: 1890 TO 1905.[1]

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER.									WOMEN 16 YEARS AND OVER.								
	Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.			Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	95,025	2,774	2,129				145,718	134,354	88,837	81,937	4,643	4,879				124,711	123,709	106,607
Less than $3	3,927	121	116	100.0	100.0	100.0	5,974	5,911	4,886	5,109	242	332	100.0	100.0	100.0	7,732	6,433	7,249
$3 to $4	5,118	140	217	95.9	95.6	94.5	7,869	6,718	9,061	8,597	387	545	93.8	94.8	93.2	13,094	10,268	11,940
$4 to $5	9,794	302	207	90.5	90.6	84.3	15,009	14,645	8,617	11,948	675	1,016	83.3	86.5	82.0	18,208	18,062	22,174
$5 to $6	10,840	278	193	80.2	79.7	74.6	16,612	13,435	8,084	13,705	897	1,104	68.7	71.9	61.2	20,827	23,876	24,093
$6 to $7	14,232	332	262	68.8	69.7	65.5	21,858	16,122	10,927	14,861	892	1,008	52.0	52.6	38.6	22,573	23,752	22,068
$7 to $8	12,833	304	207	53.8	57.7	53.2	19,672	14,645	8,617	11,354	641	495	33.9	33.4	17.9	17,335	17,072	10,767
$8 to $9	9,192	250	287	40.3	46.8	43.5	14,135	12,092	11,993	8,100	441	237	20.0	19.6	7.8	12,346	11,752	5,224
$9 to $10	8,444	320	211	30.6	37.8	30.0	12,969	15,451	8,795	4,912	269	68	10.1	10.1	2.9	7,483	7,175	1,493
$10 to $12	9,547	407	288	21.7	26.3	20.1	14,572	19,750	11,993	2,992	185	62	4.1	4.3	1.5	4,614	4,948	1,386
$12 to $15	6,991	232	90	11.7	11.6	6.6	10,783	11,286	3,731	343	14	11	0.4	0.3	0.2	499	371	213
$15 to $20	2,867	69	37	4.3	3.2	2.4	4,371	3,359	1,599	[2] 16		1	(3)		(3)			
$20 to $25	873	11	7	1.3	0.7	0.6	1,311	537	267									
$25 and over	367	8	7	0.4	0.3	0.3	583	403	267									

[1] For calendar year 1904.

[2] $15 and over.

[3] Less than one-tenth of 1 per cent.

TABLE 10.—KNITTING MILLS—NUMBER OF MEN, WOMEN, AND CHILDREN BY CLASSIFIED WEEKLY EARNINGS, WITH CUMULATIVE PERCENTAGES, AND ESTIMATED DISTRIBUTION OF AVERAGE NUMBER IN ALL ESTABLISHMENTS: 1890 TO 1905.[1]

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER.									WOMEN 16 YEARS AND OVER.		
	Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.			Number.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	11,558	561	393	......	......	......	25,167	21,154	14,846	29,502	1,677	1,242
Less than $3	326	1	14	100.0	100.0	100.0	705	42	520	2,160	56	77
$3 to $4	414	18	9	97.2	99.8	96.5	906	677	341	3,016	187	157
$4 to $5	683	25	27	93.6	96.6	94.2	1,485	952	1,024	4,421	244	219
$5 to $6	782	28	11	87.7	92.1	87.3	1,711	1,058	416	4,779	252	187
$6 to $7	1,447	86	51	80.9	87.1	84.5	3,146	3,237	1,930	5,104	265	161
$7 to $8	1,608	77	52	68.4	71.8	71.5	3,498	2,898	1,960	4,157	220	155
$8 to $9	1,417	76	59	54.5	58.1	58.3	3,096	2,856	2,227	2,576	177	117
$9 to $10	1,288	56	59	42.2	44.6	43.3	2,794	2,115	2,227	1,807	131	18
$10 to $12	1,544	47	38	31.1	34.6	28.3	3,347	1,777	1,440	1,064	100	69
$12 to $15	1,072	86	26	17.8	26.2	18.6	2,340	3,237	980	370	39	[2]13
$15 to $20	669	34	27	8.5	10.9	12.0	1,460	1,290	1,024	[2]48	[2]6	6
$20 to $25	205	19	15	2.7	4.8	5.1	453	719	564	......	......	......
$25 and over	103	8	5	0.9	1.4	1.3	226	296	193	......	......	......

WEEKLY EARNINGS.	WOMEN 16 YEARS AND OVER—continued.						CHILDREN UNDER 16 YEARS.[3]								
	Cumulative percentage.			Estimated distribution of average number in all establishments.			Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	......	......	......	68,867	53,565	40,826	4,287	275	86	......	......	......	9,681	8,668	3,916
Less than $3	100.0	100.0	100.0	5,027	1,768	2,531	1,842	184	60	100.0	100.0	100.0	4,163	5,799	2,733
$3 to $4	92.7	96.7	93.8	7,025	5,999	5,144	1,477	81	24	57.0	33.1	30.2	3,330	2,557	1,093
$4 to $5	82.5	85.5	81.2	10,330	7,767	7,185	569	7	2	22.6	3.6	2.3	1,288	217	90
$5 to $6	67.5	71.0	63.6	11,157	8,035	6,165	251	2	......	9.3	1.1	......	571	61	......
$6 to $7	51.3	56.0	48.5	11,914	8,463	5,308	109	1	......	3.4	0.4	......	242	34	......
$7 to $8	34.0	40.2	35.5	9,710	7,017	5,103	34	......	......	0.9	......	......	77	......	......
$8 to $9	19.9	27.1	23.0	5,991	5,678	3,838	[4]5	......	......	0.1	......	......	[4]10	......	......
$9 to $10	11.2	16.5	13.6	4,201	4,178	2,654	......	......	......	......	......	......	......	......	......
$10 to $12	5.1	8.7	7.1	2,479	3,214	2,286	......	......	......	......	......	......	......	......	......
$12 to $15	1.5	2.7	1.5	895	1,232	408	......	......	......	......	......	......	......	......	......
$15 to $20	0.2	0.4	0.5	[2]138	[2]214	[2]204	......	......	......	......	......	......	......	......	......

[1] For the calendar year 1904. [2] $15 and over. [3] No boys under 16 included for 1890 or 1900. [4] $8 and over.

TABLE 11.—SHOES—NUMBER OF MEN AND WOMEN BY CLASSIFIED WEEKLY EARNINGS, WITH CUMULATIVE PERCENTAGES, AND ESTIMATED DISTRIBUTION OF AVERAGE NUMBER IN ALL ESTABLISHMENTS: 1890 TO 1905.[1]

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER.									WOMEN 16 YEARS AND OVER.								
	Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.			Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	59,142	2,092	1,424	......	......	......	95,257	90,415	91,406	30,195	1,334	931	......	......	......	49,535	46,894	39,849
Less than $3	1,004	3	2	100.0	100.0	100.0	1,619	90	91	1,370	14	19	100.0	100.0	100.0	2,279	516	797
$3 to $4	1,446	14	18	98.3	99.9	99.9	2,286	633	1,188	2,052	53	38	95.4	98.9	98.0	3,369	1,876	1,634
$4 to $5	2,094	18	29	95.9	99.2	98.6	3,334	814	1,828	2,814	78	85	88.6	94.9	93.9	4,607	2,720	3,626
$5 to $6	2,594	43	42	92.4	98.3	96.6	4,191	1,808	2,651	3,510	116	115	79.3	89.1	84.8	5,746	4,080	4,941
$6 to $7	3,557	54	75	88.0	96.3	93.7	5,716	2,351	4,844	3,691	135	136	67.7	80.4	72.4	6,043	4,736	5,818
$7 to $8	3,900	80	72	82.0	93.7	88.4	6,287	3,436	4,570	3,745	141	111	55.5	70.3	57.8	6,142	4,971	4,742
$8 to $9	4,077	79	68	75.4	89.9	83.4	6,573	3,436	4,387	3,164	155	106	43.1	59.7	45.9	5,201	5,440	4,543
$9 to $10	5,319	146	82	68.5	86.1	78.6	8,573	6,329	5,302	2,995	169	91	32.6	48.1	34.5	4,904	5,955	3,905
$10 to $12	8,609	290	199	59.5	79.1	72.8	13,908	12,568	12,797	3,572	251	110	22.7	35.4	24.7	5,845	8,816	4,702
$12 to $15	11,565	550	339	44.9	65.2	58.8	18,670	23,779	21,755	2,394	166	79	10.9	16.6	12.9	3,913	5,815	3,387
$15 to $20	10,811	507	363	25.3	38.9	35.0	17,432	21,880	23,309	[2]888	[2]56	[2]41	3.0	4.2	4.4	[2]1,486	[2]1,969	[2]1,754
$20 to $25	3,046	188	91	7.0	14.7	9.5	4,858	8,137	5,850	......	......	......	......	......	......	......	......	......
$25 and over	1,120	120	44	1.9	5.7	3.1	1,810	5,154	2,834	......	......	......	......	......	......	......	......	......

[1] For the calendar year 1904. [2] $15 and over.

TABLE 12.—*Tanneries—number of men by classified weekly earnings, with cumulative percentages, and estimated distribution of average number in all establishments: 1890 to 1905.*[1]

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER.								
	Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	38,293	1,276	667	......	......	......	54,517	50,402	41,733
Less than $3	519	5	3	100.0	100.0	100.0	763	202	167
$3 to $4	405	32	5	98.6	99.6	99.6	654	1,260	334
$4 to $5	1,024	19	1	97.4	97.1	98.8	1,472	756	83
$5 to $6	1,350	24	16	94.7	95.6	98.6	1,908	958	1,002
$6 to $7	2,623	87	18	91.2	93.7	96.2	3,707	3,427	1,127
$7 to $8	3,826	43	3	84.4	86.9	93.5	5,452	1,714	167
$8 to $9	4,524	73	28	74.4	83.5	93.1	6,433	2,873	1,753
$9 to $10	6,840	153	38	62.6	77.8	88.9	9,759	6,048	2,379
$10 to $12	8,317	398	134	44.7	65.8	83.2	11,830	15,725	8,388
$12 to $15	5,510	282	178	23.0	34.6	63.1	7,850	11,139	11,143
$15 to $20	2,644	143	186	8.6	12.5	36.4	3,762	5,645	11,643
$20 to $25	468	10	38	1.7	1.3	8.5	654	403	2,379
$25 and over	183	7	19	0.5	0.5	2.8	273	252	1,168

[1] For the calendar year 1904.

TABLE 13.—*Wagons—number of men by classified weekly earnings, with cumulative percentages, and estimated distribution of average number in all establishments: 1890 to 1905.*[1]

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER.								
	Number.			Cumulative percentage.			Estimated distribution of average number in all establishments.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	40,981	1,332	1,220	......	......	......	59,411	57,209	55,403
Less than $3	641	1	3	100.0	100.0	100.0	951	57	111
$3 to $4	691	6	14	98.4	99.9	99.8	1,010	286	609
$4 to $5	1,080	15	17	96.7	99.4	98.7	1,545	629	775
$5 to $6	1,224	8	13	94.1	98.3	97.3	1,782	343	609
$6 to $7	2,300	43	23	91.1	97.7	96.2	3,327	1,831	1,053
$7 to $8	3,116	49	29	85.5	94.5	94.3	4,515	2,117	1,330
$8 to $9	2,756	37	45	77.9	90.8	91.9	3,981	1,602	2,050
$9 to $10	6,325	105	131	71.2	88.0	88.2	9,149	4,519	5,928
$10 to $12	6,687	215	223	55.8	80.1	77.5	9,684	9,211	10,139
$12 to $15	8,839	373	329	39.5	64.0	59.2	12,833	16,019	14,959
$15 to $20	6,206	341	262	17.9	36.0	32.2	9,030	14,645	11,912
$20 to $25	898	87	66	2.7	10.4	10.7	1,307	3,719	2,992
$25 and over	218	52	65	0.5	3.9	5.3	297	2,231	2,936

[1] For the calendar year 1904.

These tables give not only the actual numbers and the cumulative percentages based on them, as shown in the special reports for the respective censuses, but also the distribution of the average number of wage-earners employed in all establishments in each of the industries, in order to show the probable maximum classification at each amount and the degree to which the statistics of classified earnings are representative. The numbers shown in the special report for 1890 and 1900 are for wage-earners in establishments which were most carefully selected as representing prevailing conditions in different sections of the country. In some instances the small numbers considered may have had the tendency to secure a somewhat larger proportion of higher paid employees than were reported at the census of 1905. In other words, the larger numbers included at the last census, reported by establishments in all sections of the country and engaged in all branches of the different industries, tend more nearly to equalize wage conditions between skilled and unskilled labor, and to cause a larger proportion of the total number to be shown at the lower amounts.

The agreement in the location of the median for the three census years is the most striking feature of the percentages in several of the industries shown. In agricultural implements the group $10 to $12, in cotton mills the group $7 to $8, and in knitting mills the group $8 to $9 contained the median for men at all three censuses. For agricultural implements and knitting mills the percentage at the median group was smaller in 1905 than at either of the preceding censuses. For cotton mills it was smaller than in 1900, but slightly larger than in 1890. In the other industries there is a slight change, indicating a slightly smaller proportion of men at the higher earnings for 1905 than for 1900. For shoes, carpet mills, wagons, cars and railroad shops, and tanneries the median in 1905 occurs in a lower group than in 1890; for cigars it is in the same group. For collars and cuffs the statistics, which are only for New York state, disclose lower earnings than in 1900. These variations may be due in part, at least, to the larger numbers shown and greater diversity of establishments represented by the figures of the last census.

In cigars the median for women appears in the same group for each of the three years, with a slight increase in the percentage over 1890 and a considerable decrease from 1900; in cotton mills the median group is the same in 1900 and 1905 but with a slightly decreased percentage in 1905, while the 1890 median is in a lower group. In knitting mills the median group for both 1900 and 1905 is the same, and higher than that in 1890, although the percentage at the last census is less than it was in 1900. In shoes the median occurs in the same group in 1890 and 1905, but with a smaller percentage for the latter census; a higher group contains the median for 1900. In the clothing industry the earnings of women appear to have increased, the group containing the median being greater by $1 than in either 1890 or 1900. In carpet mills the median for 1905 is found one group lower than at either of the preceding censuses. In the manufacture of collars and cuffs in the state of New York the median group has remained the same at all three censuses, but contains a slightly larger percentage of the wage-earners in 1900. The two industries in which children are compared reveal higher earnings in 1905.

Comparison of earnings in same establishments.—The report of the Twelfth Census made comparison of the data for weekly earnings in 26 separate establishments in 1890 and 1900. One of these establishments had gone out of business before the census of 1905, but fairly satisfactory reports were received for the remaining 25, and the comparison of the data for them is of interest as showing the changes in earnings due to various factors, such as the substitution of low-priced for high-priced labor, shorter or longer hours of work, the introduction or abandonment of machinery, change in the character of the materials or products, and other conditions that are equalized or can not be detected in the comparisons for an industry which includes different establishments at each succeeding census. The object of the establishment comparison is to disclose the character, rather than to furnish an exact measure, of the changes which have taken place. Any deductions as to the course of wages drawn from such a comparison must be made with caution.[1] Changes in the product or in the nature of the work, amount of lost time, and the completeness of the pay rolls copied at the different censuses are the principal factors affecting a comparison of the earnings in the same establishment.

There are comparatively few establishments that do not make changes from year to year in some manner affecting the rates of pay or earnings for all or a portion of the employees. To be complete the statistics should be accompanied with a full description of the establishment, its surroundings, methods of business, machinery, character of materials used and products manufactured, number of men, women, and children employed, character of the occupation performed by each class of employees, hours of employment, and changes in these and other conditions. Manifestly it is impracticable to give all this information for every establishment compared, but a short descriptive statement accompanies each. The classifications and establishment numbers are those used in the report of 1900. Unless otherwise stated, comments upon changes in earnings are based on the position of the median group and the percentage accumulated thereat.

[1] Twelfth Census, Employees and Wages, page cvii.

Cotton mills: Establishment No. 5.

LOCATION: Middle states.
PRODUCTS: Cotton yarns and waste.
NORMAL WORKING TIME PER WEEK: Each period, 60 hours.
SPECIAL FEATURES: Week covered for 1905 ended December 31, 1904; for 1900, March 3; for 1890, July 12. There has been an increase in the number of men and a decrease in the number of women and children. The number of producing spindles increased from 48,424 in 1900 to 57,472 in 1905. Annual quantity of cotton consumed increased from 8,940,381 pounds for 1900 to 8,994,865 pounds for 1905. The percentage of men at the higher earnings has decreased at each census, and the percentage of women at such earnings has increased. So few children were reported at the census of 1905 that the percentages have no significance. The establishment ran some of its spindles at night in 1890 and 1900. The number operated nights as well as days for the whole of 1900 was 13,408; for 6 months, 10,382. There has been an enlargement of the plant since then and it is probable that the new addition was in operation during the time covered by the report of 1905, thus avoiding the necessity of night work. As the night and day forces were separate, the night work could have had no extraordinary effect on the classified weekly earnings. The women were almost exclusively paid by the piece; those working at night might naturally accomplish less than those working in the daytime. This would explain the higher earnings of women for 1905—all daytime work—than for 1900, when part of the force worked nights. The men were almost exclusively paid by the day. Their earnings were a little less for 1905 than in 1900. Doubtless some of these day men worked overtime when the spindles were operated at night, receiving extra pay which disappeared when the occasion for it no longer existed.

[Each cumulative percentage shows the proportion of total number of persons receiving earnings as great as, or greater than, the lowest earnings of the given group.]

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						CHILDREN UNDER 16 YEARS AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.			Number.			Cumulative percentage.			Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	350	342	165				139	164	140				4	70	12			
Less than $3		8		100.0	100.0	100.0			7	100.0	100.0	100.0		7	7	100.0	100.0	100.0
$3 to $4	50	27	19	100.0	97.7	100.0		19	11	100.0	100.0	95.0	3	63	5	100.0	90.0	41.7
$4 to $5	60	40	14	85.7	89.8	88.5	22	28	26	100.0	88.4	87.2	1			25.0		
$5 to $6	62	39	4	68.6	78.1	80.0	42	40	32	84.2	71.3	68.6						
$6 to $7	36	26	15	50.9	67.7	77.6	13	33	60	54.0	46.9	45.7						
$7 to $8	25	41	42	40.6	59.1	68.5	27	25	4	44.6	26.8	2.8						
$8 to $9	12	27	6	33.4	47.1	43.0	25	12		25.2	11.6							
$9 to $10	12	14	9	30.0	39.2	39.4	6	7		7.2	4.3							
$10 to $12	13	24	43	26.6	35.1	33.9	4			2.9								
$12 to $15	70	83	7	22.9	28.1	7.8												
$15 to $20	5	7	3	2.9	3.8	3.6												
$20 to $25	1	2	3	1.5	1.8	1.8												
$25 and over	4	4		1.2	1.2													

Dyeing and finishing textiles: Establishment No. 13.

LOCATION: New England states.
PRODUCTS: Bleaching, dyeing, finishing, mercerizing, and printing piece cotton goods.
NORMAL WORKING TIME PER WEEK: Each period, 60 hours.
SPECIAL FEATURES: Week covered for 1905 ended December 10, 1904; for 1900, March 17; for 1890, March 15. No children were reported at any of the censuses. There was a large increase in total number of wage-earners between 1890 and 1900, but no material change between 1900 and 1905. The cumulative percentages indicate a slightly larger proportion at the higher earnings for 1890 and 1905 than for 1900. In 1900 the establishment was an independent corporation; it is now one branch of a corporation that has a number of other branches, with the same or similar products.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.			Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	649	685	280				85	44	16			
Less than $3	16	14	4	100.0	100.0	100.0	2	7		100.0	100.0	100.0
$3 to $4	9	24	2	97.5	97.9	98.6	3	15		97.6	84.1	100.0
$4 to $5	20	37	15	96.1	94.4	97.9	8	8	4	94.1	50.0	100.0
$5 to $6	34	70	16	93.0	89.0	92.5	46	11	2	84.7	31.8	75.0
$6 to $7	44	120	19	87.8	78.8	86.8	15	3	10	30.6	6.8	62.5
$7 to $8	110	117	42	81.0	61.3	80.0	2			13.0		
$8 to $9	152	86	55	64.0	44.2	65.0	9			10.6		
$9 to $10	71	59	24	40.6	31.6	45.3						
$10 to $12	70	63	47	29.7	23.0	36.7						
$12 to $15	56	40	28	18.9	13.8	19.9						
$15 to $20	33	30	16	10.3	8.0	9.9						
$20 to $25	2	7	6	5.2	3.6	4.2						
$25 and over	32	18	6	4.9	2.6	2.1						

Knitting mills: Establishment No. 15.

LOCATION: New England states.
PRODUCTS: Knit goods, woolen and cotton shirts, drawers, and hosiery.
NORMAL WORKING TIME PER WEEK: 1905, 54 hours in winter and 55 hours in summer; 1900 and 1890, 60 hours.
SPECIAL FEATURES: Week covered for 1905 ended December 24, 1904; for 1900, April 21; for 1890, April 19. The number of men employed has increased at each census, while the number of women and children has decreased. The smaller proportion of men and women at the higher earnings for 1905 than for 1900 may be explained in part by the fact that a large proportion were pieceworkers, whose earnings were apparently reduced by the fewer hours worked per week at the later census. The week covered by the inquiry of 1900 ended April 21, when the factory was in operation 10 hours a day and 60 hours for the week, while the statistics for 1905 covered the week ending December 24, 1904, when the factory was operated only 9 hours a day and 54 hours for the week. For the 300 pieceworkers there is therefore a reduction of 1,800 hours' earnings, and yet the median for men narrowly escapes location in the same group as in 1900. The establishment reported that more yarn was purchased and used during the year covered by the report for 1905 than in 1900 and there was a slight reduction in the number of spinners. Some allowance should be made for differences in methods, but the figures as reported indicate a slight increase in the earnings for 1900 and 1905 as compared with 1890.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						CHILDREN UNDER 16 YEARS AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.			Number.			Cumulative percentage.			Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	116	115	110	......	......	......	278	311	339	......	......	......	13	[1] 25	[1] 33	......	......	......
Less than $3	......	......	3	......	......	100.0	10	5	13	100.0	100.0	100.0	2	4	14	100.0	100.0	100.0
$3 to $4	1	1	2	100.0	100.0	92.7	26	21	36	96.4	98.4	96.2	7	11	17	84.6	84.0	57.6
$4 to $5	3	2	1	99.1	99.1	95.4	56	55	70	87.0	91.7	85.6	4	7	2	30.8	40.0	6.1
$5 to $6	4	2	2	96.5	97.4	94.5	60	53	77	66.9	74.0	64.9	......	2	......	......	12.0	......
$6 to $7	10	9	9	93.1	95.7	92.7	49	69	58	45.3	57.0	42.2	......	1	......	......	4.0	......
$7 to $8	14	9	15	84.5	87.9	84.5	30	55	50	27.7	34.8	25.1	......	......	......	......	......	......
$8 to $9	16	22	21	72.4	80.1	70.9	26	36	29	16.9	17.1	10.4	......	......	......	......	......	......
$9 to $10	11	10	11	58.6	61.0	51.8	14	12	6	7.5	5.5	1.8	......	......	......	......	......	......
$10 to $12	15	12	10	49.1	52.3	41.8	7	5	......	2.5	1.6	......	......	......	......	......	......	......
$12 to $15	25	21	14	32.2	41.9	32.7	......	......	......	......	......	......	......	......	......	......	......	......
$15 to $20	10	18	15	14.7	23.6	20.0	......	......	......	......	......	......	......	......	......	......	......	......
$20 to $25	6	8	7	6.1	7.9	6.4	......	......	......	......	......	......	......	......	......	......	......	......
$25 and over	1	1	......	0.9	0.9	......	......	......	......	......	......	......	......	......	......	......	......	......

[1] Eleven males in 1900 and 2 in 1890 under 16 years excluded because of numerical unimportance.

Knitting mills: Establishment No. 16.

LOCATION: Middle states.
PRODUCTS: Men's, women's, and children's knit underwear, merino or mixed, and all wool.
NORMAL WORKING TIME PER WEEK: Each period, 60 hours.
SPECIAL FEATURES: Week covered for 1905 ended October 15, 1904; for 1900, October 6; for 1890, October 4. The men were almost exclusively timeworkers in 1900 and 1890, their earnings have increased steadily. There were many more pieceworkers in 1900 than in 1890 among the women and their earnings increased. Three children were reported for 1905, 4 in 1900, and 8 in 1890, but no comparison is practicable, as the returns for the previous censuses were not tabulated. The establishment has largely increased its machinery and output.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.			Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	133	140	159	......	......	......	302	272	247	......	......	......
Less than $3	......	......	......	100.0	100.0	100.0	1	3	1	100.0	100.0	100.0
$3 to $4	3	......	2	100.0	100.0	100.0	16	10	15	99.7	98.9	99.6
$4 to $5	6	8	4	97.7	100.0	98.8	24	7	32	94.4	95.2	93.5
$5 to $6	11	2	3	93.2	94.3	96.3	41	17	12	86.5	92.6	80.6
$6 to $7	6	23	30	84.9	92.9	94.4	24	27	26	72.9	86.4	75.7
$7 to $8	7	8	27	80.4	76.5	75.5	28	40	52	65.0	76.5	65.2
$8 to $9	11	35	27	75.1	70.8	58.5	40	43	41	55.7	61.8	44.1
$9 to $10	34	10	35	66.8	45.8	41.5	59	29	20	42.5	46.0	27.5
$10 to $12	14	8	9	41.3	38.6	19.5	29	56	38	22.9	35.3	19.4
$12 to $15	24	28	7	30.8	32.9	13.8	29	35	7	13.3	14.7	4.0
$15 to $20	12	7	8	12.8	12.9	9.4	[1] 11	[1] 5	[1] 3	3.7	1.8	1.2
$20 to $25	3	6	2	3.8	7.9	4.4	......	......	......	......	......	......
$25 and over	2	5	5	1.5	3.6	3.1	......	......	......	......	......	......

[1] $15 and over.

Knitting mills: Establishment No. 18.

LOCATION: Central states.
PRODUCTS: Knit gloves and mittens, woolen hose and half hose, lumbermen's stockings.
NORMAL WORKING TIME PER WEEK: 1905, 59 hours; 1900 and 1890, 60 hours.
SPECIAL FEATURES: Week covered for 1905 ended May 28, 1904; for 1900, May 12; for 1890, May 10. There was a great increase each year in the number of women, principally spinners, very many additional plain flat knitting machines having been installed; and a great decrease in children from 1900 to 1905. The number of men increased from 1890 to 1900, but slightly decreased from 1900 to 1905. All the men were timeworkers from 1890 to 1900, while practically all the women and more than five-sixths of the children were pieceworkers. Men's earnings decreased from 1890 to 1900, but increased from 1900 to 1905; women's increased steadily from 1890 to 1905, and children's likewise. Although the median group for children was "less than $3" in each year, the percentage above that group has steadily increased, the increase being very large between 1900 and 1905.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						CHILDREN UNDER 16 YEARS AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.			Number.			Cumulative percentage.			Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	51	54	27				281	157	80				146	202	53			
Less than $3			1	100.0	100.0	100.0		4	7	100.0	100.0	100.0	89	186	52	100.0	100.0	100.0
$3 to $4		16	8	100.0	100.0	96.3	109	82	41	100.0	97.4	91.2	52	16	1	39.0	7.9	2.0
$4 to $5	15	4	2	100.0	70.4	66.6	90	47	19	61.2	45.2	40.0	5			3.4		
$5 to $6	6	5	1	70.6	63.0	59.2	57	17	11	29.2	15.2	16.2						
$6 to $7	2	5	1	58.8	53.7	55.5	11	5		8.9	4.4	2.4						
$7 to $8	3	2	1	54.9	44.4	51.8	10	1	1	5.0	1.2	2.4						
$8 to $9	1		1	49.1	40.7	48.1	1	1		1.5	0.6	1.2						
$9 to $10	2	4	1	47.1	40.7	44.4	2		1	1.1		1.2						
$10 to $12	5	4	2	43.2	33.3	40.7	1			0.4								
$12 to $15	10	4	2	33.4	25.9	33.3												
$15 to $20	6	7	5	13.8	18.5	25.9												
$20 to $25	1	1	2	2.0	5.5	7.4												
$25 and over		2			3.7													

Woolen mills: Establishment No. 24.

LOCATION: New England states.
PRODUCTS: Cassimeres and cloakings; union or cotton mixed woven goods.
NORMAL WORKING TIME PER WEEK: 1905, 63 hours; 1900 and 1890, 60 hours.
SPECIAL FEATURES: Week covered for 1905 ended February 18; for 1900, May 19; for 1890, May 17. The increase in normal working time per week between 1900 and 1905 was 3 hours, the working day being extended from 10 to 10½ hours. There were also 300 extra hours' time worked during the year as returned in the report for 1905. Distributed equally throughout the 50 working weeks these amount to 6 hours a week, and are therefore a material cause of the greater earnings shown. Almost all the women in 1900 and a little more than one-third of the men were pieceworkers. The number of male weavers and of women mainly in all other occupations was considerably increased for 1905. No children were returned for 1905; 5 were reported for 1900 and 1890, but not tabulated. The manufacture of cloakings seems to have been abandoned since 1900.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.			Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	101	73	63				89	32	58			
Less than $3		3	4	100.0	100.0	100.0		3	2	100.0	100.0	100.0
$3 to $4		11		100.0	95.9	93.7		10	13	100.0	90.6	96.5
$4 to $5		12	16	100.0	80.8	93.7	20	7	9	100.0	59.4	74.1
$5 to $6		9	5	100.0	64.4	68.3	5	6	10	77.5	37.5	58.6
$6 to $7	58	12	10	100.0	52.1	60.4	6	4	12	71.9	18.7	41.4
$7 to $8		8	10	42.6	35.7	44.5	30	1	3	65.2	6.2	20.7
$8 to $9	6	7	3	42.6	24.7	28.6	20	1	6	31.5	3.1	15.5
$9 to $10		2	9	36.7	15.1	23.8	5		2	9.0		5.2
$10 to $12	12	5		36.7	12.4	9.5	3		1	3.4		1.7
$12 to $15	10	1	2	24.8	5.5	9.5						
$15 to $20	10	3	3	14.9	4.1	6.4						
$20 to $25	5		1	5.0		1.6						
$25 and over												

Woolen mills: Establishment No. 27.

Location: Middle states.

Products: Worsted and woolen goods. Yarn is manufactured for consumption in the mill.

Normal working time per week: Each period, 60 hours.

Special features: Week covered for 1905 ended December 3, 1904; for 1890 and 1900 it ended in January. The number of wage-earners covered by the inquiry of 1900 was less than the number reported in 1890, but there was an increase in the number of men and women for 1905. The number of children decreased at each census. The cumulative percentages indicate an increase in the weekly earnings at each census, a larger proportion being shown for the higher groups.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						CHILDREN UNDER 16 YEARS AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.			Number.			Cumulative percentage.			Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	430	329	364	......	......	......	331	226	352	......	......	......	45	50	72	......	......	......
Less than $3	15	17	17	100.0	100.0	100.0	21	11	46	100.0	100.0	100.0	7	8	62	100.0	100.0	100.0
$3 to $4	3	17	39	96.5	94.8	95.3	15	27	117	93.7	95.1	86.9	17	42	10	84.5	84.0	13.9
$4 to $5	28	30	19	95.8	89.6	84.6	70	99	92	89.2	83.2	53.7	21	......	......	46.7	......	......
$5 to $6	43	10	29	89.3	80.5	79.4	118	5	23	68.0	39.4	27.5	......	......	......	......	......	......
$6 to $7	46	50	83	79.3	77.5	71.4	16	13	17	32.3	37.2	21.0	......	......	......	......	......	......
$7 to $8	89	46	58	68.6	62.3	48.6	23	38	14	27.5	31.4	16.2	......	......	......	......	......	......
$8 to $9	21	14	27	47.9	48.3	32.7	28	3	18	20.5	14.6	12.2	......	......	......	......	......	......
$9 to $10	18	20	30	43.0	44.1	25.3	10	4	17	12.0	13.3	7.1	......	......	......	......	......	......
$10 to $12	75	60	30	38.8	38.0	17.0	21	15	7	9.0	11.5	2.3	......	......	......	......	......	......
$12 to $15	59	42	19	21.4	19.8	8.7	8	11	1	2.7	4.9	0.3	......	......	......	......	......	......
$15 to $20	29	22	10	7.7	7.0	3.5	1	......	......	0.3	......	......	......	......	......	......	......	......
$20 to $25	4	1	3	0.9	0.3	0.8	......	......	......	......	......	......	......	......	......	......	......	......
$25 and over	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

Pianos: Establishment No. 62.

Location: Middle states.

Products: Pianos.

Normal working time per week: 1905, 54 hours; 1900 and 1890, 59 hours.

Special features: Week covered for 1905 ended October 29, 1904; for 1900, June 16; for 1890, June 14. A larger proportion of partially manufactured materials, such as actions, keys, cases, etc., were reported at the census of 1905 than at prior censuses. The establishment is apparently changing its practice of manufacturing from crude material to the assembling of parts manufactured in other factories. The number of wage-earners has decreased at each census; the percentage at the higher rates was slightly less for 1900 and 1905 than for 1890, but greater for 1905 than for 1900. Six males under 16 years of age were reported for 1900 and 15 for 1890, although not tabulated because of "numerical unimportance." None was returned for 1905. No females were reported in any year.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890
Total	45	136	169	......	......	......
Less than $3	......	......	......	100.0	100.0	100.0
$3 to $4	1	1	2	100.0	100.0	100.0
$4 to $5	......	......	5	97.8	99.3	98.8
$5 to $6	......	4	4	97.8	99.3	95.9
$6 to $7	1	2	......	97.8	96.3	93.5
$7 to $8	......	6	4	95.6	94.8	93.5
$8 to $9	......	3	3	95.6	90.4	91.1
$9 to $10	5	9	11	95.6	88.2	89.3
$10 to $12	7	25	16	84.5	81.6	82.8
$12 to $15	12	35	61	68.9	63.2	73.3
$15 to $20	14	33	45	42.2	37.5	37.2
$20 to $25	2	12	10	11.1	13.2	10.6
$25 and over	3	6	8	6.7	4.4	4.7

Wagons: Establishment No. 64.

Location: Middle states.

Products: Wagons, trucks, carts, and wheelbarrows.

Normal working time per week: 1905, 58 hours; 1900 and 1890, 60 hours.

Special features: Week covered for 1905 ended September 17, 1904; for 1900, May 25; for 1890, May 23. The reduction in the hours per week from 1900 to 1905 is reflected in the decreased earnings shown for a slightly increased force. It is probable also that fuller time was worked during the spring weeks, which are shown for the previous censuses, than in the September week shown for 1905. The character of the output has apparently remained the same from census to census.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890
Total	26	21	28	......	......	......
Less than $3	......	......	......	100.0	100.0	100.0
$3 to $4	......	......	......	100.0	100.0	100.0
$4 to $5	1	......	......	100.0	100.0	100.0
$5 to $6	......	......	......	96.2	100.0	100.0
$6 to $7	......	2	......	96.2	100.0	100.0
$7 to $8	......	......	1	96.2	90.5	100.0
$8 to $9	1	......	2	96.2	90.5	96.4
$9 to $10	8	3	4	92.4	90.5	89.3
$10 to $12	1	1	5	61.6	76.2	75.0
$12 to $15	8	13	15	57.7	71.4	57.2
$15 to $20	7	2	1	26.9	9.5	3.6
$20 to $25	......	......	......	......	......	......
$25 and over	......	......	......	......	......	......

Wagons: Establishment No. 67.

LOCATION: Middle states.
PRODUCTS: Coaches and fine carriages.
NORMAL WORKING TIME PER WEEK: 1905, 51 hours; 1900 and 1890, 54 hours.
SPECIAL FEATURES: Week covered for 1905 ended October 6, 1904; for 1900, June 22; for 1890, June 21. About one-third of the men were pieceworkers. Three children were reported in 1890, but none in 1900 or 1905. The percentage of men at the higher earnings increased from 1890 to 1900 and then slightly decreased. A considerable reduction in the force from 1900 to 1905 had a substantially uniform effect throughout the scale. Extra time was worked during the year, and therefore presumably during the week selected, and this, it is probable, neutralized the effect of a reduction of 3 hours a week due to the introduction of an 8½-hour in place of a 9-hour day. In 1900 the week during which the largest number of wage-earners was employed appears to have been in the month of April; in the year covered by the report for 1905 it was in October.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890
Total	91	115	89			
Less than $3				100.0	100.0	100.0
$3 to $4			1	100.0	100.0	100.0
$4 to $5	2		1	100.0	100.0	98.9
$5 to $6	2		1	97.8	100.0	97.8
$6 to $7	3	6		95.6	100.0	96.7
$7 to $8	2	1		92.3	94.8	96.7
$8 to $9	2	2	1	90.1	93.9	96.7
$9 to $10	4	6	12	87.9	92.1	95.6
$10 to $12	10	12	10	83.5	86.9	82.1
$12 to $15	30	34	22	72.5	76.5	70.8
$15 to $20	28	29	21	39.5	46.9	46.1
$20 to $25	4	19	9	8.8	21.7	22.5
$25 and over	4	6	11	4.4	5.2	12.4

Wagons: Establishment No. 68.

LOCATION: Middle states.
PRODUCTS: Hacks, undertakers' wagons, hearses, and casket wagons.
NORMAL WORKING TIME PER WEEK: 1905, 54 hours; 1900 and 1890, 60 hours.
SPECIAL FEATURES: Week covered for 1905 ended December 15, 1904; for 1900, May 17; for 1890, May 16. Practically all the wage-earners were timeworkers. The enlargement of the force by nearly one-third was apparently with men who were paid at the higher rates, for, notwithstanding the stated reduction in hours per week, the earnings of at least one-half the force were greater for the week covered by the report for 1905 than they were in 1900. The output of the establishment increased substantially between 1900 and 1905, but no overtime was reported.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890
Total	548	422	431			
Less than $3				100.0	100.0	100.0
$3 to $4	1		3	100.0	100.0	100.0
$4 to $5	3	7	4	99.8	100.0	99.3
$5 to $6	4		7	99.3	98.3	98.4
$6 to $7	13	23	11	98.6	98.3	96.8
$7 to $8	20	21	15	96.2	92.9	94.2
$8 to $9		11	18	92.5	87.9	90.7
$9 to $10	39	45	63	92.5	85.3	86.5
$10 to $12	85	65	95	85.4	74.6	71.9
$12 to $15	209	127	113	69.8	59.2	49.9
$15 to $20	163	98	83	31.7	29.1	23.7
$20 to $25	10	17	12	2.0	5.9	4.4
$25 and over	1	8	7	0.2	1.9	1.6

Foundries and metal working: Establishment No. 103.

LOCATION: Middle states.
PRODUCTS: Stoves, ranges, and heating furnaces.
NORMAL WORKING TIME PER WEEK: 1905, 60 hours; 1900, 59 hours; 1890, 60 hours.
SPECIAL FEATURES: None but men were employed, and more than three-fifths in 1900 were pieceworkers, which was a considerable increase over 1890. The earnings increased to a slight extent in 1900, and in a much larger degree during the year accounted for in the report of 1905. There was a large addition to the force, but not large enough to restore the numbers reported in 1890. Owing to a variety of reasons, one of which is given as the location of branch foundries nearer fields of consumption, the numbers for 1900 were much less than those returned at the earlier census. The output, however, has increased from year to year. Many of the molders, mounters, pattern makers, polishers, and tinners are highly skilled workmen. This statement explains in part the large percentages at the higher earnings.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890
Total	310	216	389			
Less than $3		6		100.0	100.0	100.0
$3 to $4		4	8	100.0	97.2	100.0
$4 to $5	14	2	11	100.0	95.3	97.9
$5 to $6	6	8	18	95.5	94.4	95.1
$6 to $7	12	12	26	93.6	90.7	90.5
$7 to $8	18	10	28	89.7	85.1	83.8
$8 to $9	5	26	21	83.9	80.5	76.6
$9 to $10	21	14	51	82.3	68.5	71.2
$10 to $12	28	33	64	75.5	62.0	58.1
$12 to $15	47	45	46	66.5	46.7	41.6
$15 to $20	77	34	78	51.3	25.9	29.8
$20 to $25	34	17	26	26.5	10.2	9.8
$25 and over	48	5	12	15.5	2.3	3.1

Cigars: Establishment No. 203.

Location: Middle states.
Products: Cigars.
Normal working time per week: 1905, 54 hours; 1900 and 1890, 59 hours.
Special features: Week covered for 1905 ended November 5, 1904; for 1900, August 12; for 1890, June 5. No children were reported at any of the censuses. The increase in the number of men and the decrease in the number of women since 1890 have resulted in a net increase of 24 wage-earners. There were 49 more women than men returned for 1905. The percentage of women at the higher groups of earnings increased from 1890 to 1900, but very slightly decreased from 1900 to 1905; while the percentage of men at these groups decreased in 1900 as compared with 1890 and increased in the report for 1905. The earnings for both men and women have therefore apparently increased since 1890; but those of men only since 1900. Almost all wage-earners were pieceworkers.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.			Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	123	82	62				172	254	209			
Less than $3				100.0	100.0	100.0				100.0	100.0	100.0
$3 to $4				100.0	100.0	100.0	13	6	10	100.0	100.0	100.0
$4 to $5		1		100.0	100.0	100.0	28	36	28	92.4	97.7	95.2
$5 to $6	5	4		100.0	98.8	100.0	15	26	41	76.1	83.5	81.8
$6 to $7	8	5	6	95.9	93.9	100.0	17	35	31	67.4	73.3	62.2
$7 to $8	11	9	8	89.4	87.8	90.3	19	37	28	57.5	59.5	47.4
$8 to $9	8	8	7	80.5	76.8	77.4	12	20	15	46.5	44.9	34.0
$9 to $10	12	11	6	74.0	67.0	66.1	23	29	23	39.5	37.0	26.8
$10 to $12	20	15	10	64.2	53.6	56.4	25	44	28	26.1	25.6	15.8
$12 to $15	25	13	11	47.9	35.3	40.3	15	20	4	11.6	8.3	2.4
$15 to $20	30	11	9	27.6	19.5	22.6	5	1	1	2.9	0.4	0.5
$20 to $25	4	5	5	3.2	6.1	8.1						
$25 and over												

Cigars: Establishment No. 204.

Location: Middle states.
Products: Cigars.
Normal working time per week: 1905, 56 hours; 1900 and 1890, 55 hours.
Special features: Week covered for 1905 ended January 16, 1904; for 1900 and 1890 it was the second week in June. One woman was returned in 1905, but none for 1900 or 1890, and no comparison can be made. All men were pieceworkers in 1900 and 1890, and presumably in the 1905 return. The number has been constantly reduced, but the earnings have shown a continuous increase at the higher amounts paid, although the level is low, which indicates the presence of the so-called machine process. From 1900 to 1905 the hours of labor per week seem to have been increased by 1.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890
Total	5	15	22			
Less than $3				100.0	100.0	100.0
$3 to $4				100.0	100.0	100.0
$4 to $5		4	3	100.0	100.0	100.0
$5 to $6			4	100.0	73.3	86.4
$6 to $7	1	1	5	100.0	73.3	68.2
$7 to $8	1	5	7	83.3	66.6	45.4
$8 to $9	2	3	3	66.6	33.3	13.6
$9 to $10	2	2		33.3	13.3	
$10 to $12						
$12 to $15						
$15 to $20						
$20 to $25						
$25 and over						

Cigars: Establishment No. 205.

Location: Middle states.
Products: Cigars.
Normal working time per week: 1905, 45 hours; 1900, 50 hours; 1890, 52 hours.
Special features: Week covered for 1905 ended December 10, 1904; for 1900, July 28; for 1890, July 30. Between 1890 and 1900 most of the hand cigarmakers in this establishment disappeared and more women than previously were employed as "rollers" and more men as "bunchmakers," in the machine process. All these were pieceworkers, and the number of hours they worked per week was reduced by two. In consequence the earnings of men and women from 1890 to 1900 were reduced. Between 1900 and 1905 more men pieceworkers were displaced by women pieceworkers, leaving for the most part the higher priced indispensable men wage-earners whose compensation was by the day. The hours of labor per week were still further reduced by 5. As results of these changes the proportion of men at the higher amounts increased, and the proportion of women decreased. It is noticeable that except for 1905 the earnings of women at the higher amounts were larger than those of men.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.			Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	14	25	32				43	27	21			
Less than $3				100.0	100.0	100.0				100.0	100.0	100.0
$3 to $4				100.0	100.0	100.0			1	100.0	100.0	100.0
$4 to $5		2		100.0	100.0	100.0	4	1	4	100.0	100.0	95.2
$5 to $6		5	1	100.0	92.0	100.0	2	6	3	90.7	96.3	76.2
$6 to $7		[illegible]	[illegible]	100.0	72.0	96.9	1			86.1	74.1	61.9
$7 to $8	1	4	7	100.0	40.0	81.3	2			83.8	74.1	61.9
$8 to $9	6		1	92.9	24.0	59.4	14	2	1	79.2	74.1	61.9
$9 to $10	3	1	1	50.0	24.0	56.3	9	1		46.5	66.7	57.1
$10 to $12	1		[illegible]	28.5	20.0	53.2	7	7	1	25.6	63.0	57.1
$12 to $15	1	2	9	21.4	20.0	37.6	3	10	10	9.3	37.1	52.4
$15 to $20	2	1	2	14.3	12.0	9.4	1		1	2.3		4.8
$20 to $25		2	1		8.0	3.1						
$25 and over												

Cigars: Establishment No. 206.

LOCATION: Middle states.
PRODUCTS: Cigars of medium grade.
NORMAL WORKING TIME PER WEEK: 1905, 44 hours; 1900 and 1890, 59 hours.
SPECIAL FEATURES: Week covered for 1905 ended December 17, 1904; for 1900, September 19; for 1890, September 22. In 1900 and 1890 practically all the men in this factory were pieceworkers and in 1900 more than one-half of the women were returned as timeworkers. The normal working time appears to have been materially reduced; nevertheless the earnings of the men seem to have suffered only slightly. From the distribution at the higher amounts there was probably considerable overtime. The earnings of the women were higher in the report for 1905 than in 1900, due perhaps in some degree not only to probable overtime but to the very large increase in the force, many of the newcomers receiving the higher amount.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.			Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	64	55	69				96	65	49			
Less than $3				100.0	100.0	100.0		1	2	100.0	100.0	100.0
$3 to $4			4	100.0	100.0	100.0		15	23	100.0	98.5	95.9
$4 to $5			2	100.0	100.0	94.2	20	6	5	100.0	75.4	49.0
$5 to $6			2	100.0	100.0	91.3	10	4	1	79.1	66.2	38.8
$6 to $7			10	100.0	100.0	88.4	10	4	3	68.7	60.0	36.8
$7 to $8			5	100.0	100.0	73.9		6	2	58.3	53.8	30.7
$8 to $9	10	5	1	100.0	100.0	66.7	10	7	2	58.3	44.6	26.6
$9 to $10	10	6	3	84.4	90.9	65.2	10	1		47.9	33.8	22.5
$10 to $12	10	11	9	68.8	80.0	60.8	10	13	4	37.5	32.3	22.5
$12 to $15	10	22	22	53.2	60.0	47.8	12	7	5	27.1	12.3	14.3
$15 to $20	20	11	11	37.6	20.0	15.9	14	1	2	14.6	1.5	4.1
$20 to $25	4			6.3								
$25 and over												

Cigars: Establishment No. 207.

LOCATION: Middle states.
PRODUCTS: Cigars and tobies.
NORMAL WORKING TIME PER WEEK: 1905, 45 hours; 1900 and 1890, 54 hours.
SPECIAL FEATURES: Week covered for 1905 ended August 27, 1904; for 1900 and 1890, some time in January, date not mentioned. A decrease in earnings is shown from 1900 to 1905, due perhaps to a reduction of 9 hours a week in the working time of the establishment. The wage-earners were all pieceworkers in 1890 and 1900, and presumably also during the week covered by the report for 1905. Three women were reported in 1900 and 5 in 1890, but not included in the tabulation. Therefore, the 2 women and the 2 children reported for 1905 are not given in this table.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890
Total	15	22	51			
Less than $3				100.0	100.0	100.0
$3 to $4				100.0	100.0	100.0
$4 to $5				100.0	100.0	100.0
$5 to $6				100.0	100.0	100.0
$6 to $7				100.0	100.0	100.0
$7 to $8				100.0	100.0	100.0
$8 to $9	10		4	100.0	100.0	100.0
$9 to $10		2	17	33.3	100.0	92.1
$10 to $12	5	7	12	33.3	90.9	58.8
$12 to $15		6	11		59.1	35.3
$15 to $20		7	7		31.8	13.7
$20 to $25						
$25 and over						

Cigars: Establishment No. 212.

Location: Southern states.
Products: Cigars.
Normal working time per week: 1905, 60 hours; 1900, 62 hours; 1890, 60 and 62 hours.
Special features: Week covered for 1905 ended January 23, 1904; for 1900, January 13; for 1890, January 18. There was a very great decrease in earnings of men from 1900 to 1905, following almost as great a one from 1890 to 1900, but earnings of women increased. This may be accounted for by a possible greater loss of time by the men, or on the supposition that the men were just above the age of 16, below which they would have been classed as children, and were still doing children's work; or that they were apprentices. While the force of women was increased between 1890 and 1900, that of men was considerably diminished; the earnings of both decreased. In both these years the level of the earnings of men was higher than that of women, but the reverse was true of 1905, the median in that year for women being in the same group as that for men in 1900. It might be suggested, therefore, that the better paid men have given place to women; but as the men since 1900 have been reduced in number by 2 only, while the women are less by 8, a more probable reason for the change in earnings may be found either in the substitution of less skillful men, or in the increase of time lost by the old force of men. Loss of time might be taken to be indicative of a further change in the force by which it will become more exclusively one of women. The part machine process is apparently used in the establishment.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.			Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	16	18	26	......	......	......	22	30	24	......	......	......
Less than $3	10	......	......	100.0	100.0	100.0	1	2	2	100.0	100.0	100.0
$3 to $4	4	5	4	37.5	100.0	100.0	2	8	5	95.5	93.3	91.7
$4 to $5	......	4	2	12.5	72.2	84.6	6	6	8	86.4	66.6	70.9
$5 to $6	1	2	......	12.5	50.0	76.9	4	4	7	59.1	46.6	37.6
$6 to $7	......	3	5	6.3	38.9	76.9	4	6	1	40.9	33.3	8.4
$7 to $8	......	1	7	6.3	22.3	57.6	5	1	......	22.7	13.3	4.2
$8 to $9	......	......	2	6.3	16.7	30.7	......	......	......	......	10.0	4.2
$9 to $10	......	2	3	6.3	16.7	23.0	......	......	......	......	10.0	4.2
$10 to $12	1	......	......	6.3	5.6	11.5	......	......	......	......	10.0	4.2
$12 to $15	......	......	......	......	5.6	11.5	......	......	......	......	10.0	4.2
$15 to $20	......	1	3	......	5.6	11.5	......	3	1	......	10.0	4.2
$20 to $25	......	......	......	......	......	......	......	......	......	......	......	......
$25 and over	......	......	......	......	......	......	......	......	......	......	......	......

Cigars: Establishment No. 215.

Location: Central states.
Products: Cigars.
Normal working time per week: Each period, 44 hours.
Special features: Week covered for 1905 ended November 28, 1904; for 1900, April 28; for 1890, April 26. There was a substantial increase in the earnings, much greater from 1900 to 1905 than from 1890 to 1900, and the number of wage-earners continually increased. All were pieceworkers in 1900. Six women were reported for 1905, but no comparison can be made, as the earnings of the 2 reported for 1900 were not shown.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890
Total	32	19	17	......	......	......
Less than $3	......	......	......	100.0	100.0	100.0
$3 to $4	......	......	......	100.0	100.0	100.0
$4 to $5	......	......	2	100.0	100.0	100.0
$5 to $6	......	1	......	100.0	100.0	88.3
$6 to $7	......	2	2	100.0	94.7	88.3
$7 to $8	......	1	......	100.0	84.2	76.6
$8 to $9	......	......	1	100 0	78.9	76.6
$9 to $10	5	......	2	100.0	78.9	70.7
$10 to $12	6	5	2	84.4	78.9	58.9
$12 to $15	6	9	6	65.6	52.6	47.1
$15 to $20	11	1	1	46.9	5.3	11.8
$20 to $25	4	......	1	12.5	......	5.9
$25 and over	......	......	......	......	......	......

Clothing: Establishment No. 217.

LOCATION: Middle states.
PRODUCTS: Men's clothing.
NORMAL WORKING TIME PER WEEK: Each period, 55 hours
SPECIAL FEATURES: Week covered for 1905 ended February 10, 1904; for 1900, November 17; for 1890, November 10. Earnings for men decreased at every census since 1890, but the actual numbers increased, especially from 1900 to 1905. Apparently the increase was chiefly among the medium-priced wage-earners, for a greater proportion of the men were in much higher groups in 1900 and 1890 than was the fact in the larger number shown for 1905. Earnings for women decreased considerably from 1890 to 1900, although the median was in the same group. This was accompanied by a very large increase in numbers, the increase being greatest proportionately to the total in the earnings group \$5 to \$6. From 1900 to 1905 the earnings increased, so that they were slightly higher than for 1890. The number of pieceworkers, both men and women, increased at a much higher rate from 1890 to 1900 than did the day workers. The establishment shows a very large increase in products since 1900. Five children were returned for 1905, but as the 7 returned for 1900 and the 1 returned for 1890 were not tabulated, a comparison is impracticable.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.			Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	160	77	48				193	59	28			
Less than \$3				100.0	100.0	100.0	2			100.0	100.0	100.0
\$3 to \$4		3	4	100.0	100.0	100.0	6	6	2	99.0	100.0	100.0
\$4 to \$5	3	1		100.0	96.1	91.7	13	9	3	95.9	89.8	92.9
\$5 to \$6	3	5	4	98.1	94.8	91.7	26	12	3	89.2	74.6	82.2
\$6 to \$7	2	5	2	96.2	88.3	83.4	75	7	8	75.7	54.3	71.5
\$7 to \$8	6	7	3	95.0	81.8	79.2	25	13	5	36.8	42.4	42.9
\$8 to \$9	25	2	1	91.2	72.7	73.0	16	4	2	23.8	20.4	25.0
\$9 to \$10	33	6	1	75.6	70.1	70.9	14	2	1	15.5	13.6	17.9
\$10 to \$12	19	10	5	55.0	62.3	68.8	9	3	3	8.3	10.2	14.3
\$12 to \$15	30	15	9	43.1	49.3	58.4	7	3	1	3.6	5.1	3.6
\$15 to \$20	14	18	7	24.3	29.8	39.6						
\$20 to \$25	13	2	8	15.6	6.5	25.0						
\$25 and over	12	3	4	7.5	3.9	8.3						

Clothing: Establishment No. 221.

LOCATION: Middle states.
PRODUCTS: Shirt waists, aprons, shirts, collars, and cuffs.
NORMAL WORKING TIME PER WEEK: Each period, 59 hours.
SPECIAL FEATURES: Week covered for 1905 ended March 16, 1904; for 1900 and 1890, November 8. The report for 1905 shows 8 children; the report for 1900, 3; and that for 1890, 2; but these were not tabulated because of numerical unimportance. Earnings have increased at every census since 1890 for both men and women. All the men and children were timeworkers in 1900, and nearly five-sixths of the women pieceworkers. It is probable that the 5 men, added to the force since 1900, were among the more highly paid wage-earners, and that their earnings were responsible for the increase shown. Also among the 31 additional women were, apparently, some of the most efficient workers, for numbers nearly equal to this increase are shown at the higher earnings.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.			Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	28	23	20				257	226	171			
Less than \$3				100.0	100.0	100.0	10	9	35	100.0	100.0	100.0
\$3 to \$4	2		1	100.0	100.0	100.0	30	45	46	96.1	96.0	79 5
\$4 to \$5	4			92.9	100.0	95.0	36	60	37	84.4	76.1	52.6
\$5 to \$6		7	3	78.6	100.0	95.0	50	54	32	70.4	49.6	31.0
\$6 to \$7	2	1	3	78.6	69.6	80.0	40	30	12	51.0	25.7	12.3
\$7 to \$8				71.5	65.2	65.0	34	16	5	35.4	12.4	5.3
\$8 to \$9				71.5	65.2	65.0	20	7	2	22.2	5.3	2.4
\$9 to \$10	1	1	1	71.5	65.2	65.0	14	5	2	14.4	2.2	1.2
\$10 to \$12	5	5	3	67.9	60.8	60.0	13			5.1		
\$12 to \$15	5	5	4	50.0	39.1	45.0	10			3.9		
\$15 to \$20	6	3	5	32.1	17.4	25.0						
\$20 to \$25	1	1		10.7	4.4							
\$25 and over	2			7.1								

Printing: Establishment No. 256.

Location: New England states.
Products: Newspapers.
Normal working time per week: Varied widely at each period for different occupations, from 70 to 42 hours. During 1904 the establishment was in operation 361 days and 366 nights; the number of hours per day, except Sundays, was 21, and for the week, including Sunday, 137.
Special features: Week covered for 1905 ended November 12, 1904; for 1900, March 10; for 1890, March 8. The number of men reported does not cover the entire number employed in the establishment at any of the censuses. It is probable a selection was made at each census. Typesetting machines were used during each period; 15 machine operators were reported for 1900 and 44 for 1905. Ten hand compositors were reported for 1900 and 29 for 1905. These are reasons sufficient for the marked increase in earnings. No women or children were shown for 1905; for 1900, 3, and for 1890, 8, children were reported, but they were not included in the comparisons.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK. Number. 1905	Number. 1900	Number. 1890	Cumulative percentage. 1905	Cumulative percentage. 1900	Cumulative percentage. 1890
Total	69	100	87	....	....	....
Less than $3	......	1	......	100.0	100.0	100.0
$3 to $4	2	2	......	100.0	99.0	100.0
$4 to $5	1	2	......	97.1	97.0	100.0
$5 to $6	1	4	1	95.7	95.0	100.0
$6 to $7	......	1	......	94.2	91.0	98.8
$7 to $8	......	17	13	94.2	90.0	98.8
$8 to $9	2	1	......	94.2	73.0	83.9
$9 to $10	......	1	1	91.3	72.0	83.9
$10 to $12	......	1	7	91.3	71.0	82.7
$12 to $15	2	11	6	91.3	70.0	74.6
$15 to $20	8	26	25	88.4	59.0	67.7
$20 to $25	25	20	19	76.8	33.0	39.0
$25 and over	28	13	15	40.6	13.0	17.2

Printing: Establishment No. 262.

Location: Middle states.
Products: Newspapers, job printing, bookbinding, and engraving.
Normal working time per week: 1905 and 1900, 54 hours; 1890, 60 hours.
Special features: Week covered for 1905 ended December 23, 1904; for 1900 November 16; for 1890, November 22. Typesetting machines were reported at the censuses of 1900 and 1905, but not at the census of 1890. Most of the women in 1890 and 1900 were employed in the bindery on piecework. There was an apparent increase in the earnings of men for 1900 as compared with 1890, but only a slight change, if any, at the census of 1905. The earnings of women were practically the same in 1890 and 1900, but larger for 1905. One boy under 16 was reported in 1900, but he was not included in the table. No children were reported for either 1890 or 1905. An additional product reported for 1905 was "engraving."

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK. Number. 1905	Number. 1900	Number. 1890	Cumulative percentage. 1905	Cumulative percentage. 1900	Cumulative percentage. 1890	WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK. Number. 1905	Number. 1900	Number. 1890	Cumulative percentage. 1905	Cumulative percentage. 1900	Cumulative percentage. 1890
Total	91	64	67	....	....	....	20	17	13	....	....	....
Less than $3	......	......	......	100.0	100.0	100.0	......	......	1	100.0	100.0	100.0
$3 to $4	3	2	2	100.0	100.0	100.0	......	5	4	100.0	100.0	92.3
$4 to $5	4	2	5	96.7	96.9	97.0	1	3	1	100.0	70.6	61.6
$5 to $6	3	3	8	92.3	93.8	89.6	7	3	1	95.0	53.0	53.9
$6 to $7	5	2	4	89.0	89.1	77.7	7	5	1	60.0	35.3	46.2
$7 to $8	3	5	5	83.5	86.0	71.7	1	......	......	25.0	5.9	38.5
$8 to $9	4	2	2	80.2	78.2	64.3	1	1	......	20.0	5.9	38.5
$9 to $10	5	3	2	75.8	75.1	61.3	......	......	......	15.0	....	38.5
$10 to $12	6	3	6	70.3	70.4	58.3	1	......	2	15.0	....	38.5
$12 to $15	13	20	18	63.7	65.7	49.3	2	......	1	10.0	....	23.1
$15 to $20	36	19	12	49.4	34.4	22.4	......	......	2	....	....	15.4
$20 to $25	6	3	2	9.9	4.7	4.5	......	......	......	....	....	....
$25 and over	3	......	1	3.3	....	1.5	......	......	......	....	....	....

Shoes: Establishment No. 274.

LOCATION: Middle states.

PRODUCTS: Women's, misses', and children's shoes and slippers. Apparently a greater variety of shoes were manufactured during 1900 than during the year covered by the report for 1905.

NORMAL WORKING TIME PER WEEK: Each period, 60 hours.

SPECIAL FEATURES: A week during the month of January is covered by the statistics for each census. There has been a decrease in the number of wage-earners. No children were reported for 1905. Pieceworkers formed a large proportion of the force for 1890 and 1900; they were not reported separately for 1905. The change in the character of the products and a considerable decrease in the output have evidently caused some readjustment of wages, which may account in part for the decrease in the numbers at the higher groups of earnings indicated by the cumulative percentages.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						CHILDREN UNDER 16 YEARS AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.			Number.			Cumulative percentage.			Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	126	140	155				65	72	98					57	90			
Less than $3	19		1	100.0	100.0	100.0	5		6	100.0	100.0	100.0		46	72		100.0	100.0
$3 to $4	13	4	8	84.9	100.0	99.4	13	6	5	92.3	100.0	93.9		11	18		19.3	20.0
$4 to $5	4	7	12	74.6	97.1	94.2	13	12	7	72.3	91.7	88.8						
$5 to $6	9	12	16	71.4	92.1	86.4	16	14	20	52.3	75.0	81.7						
$6 to $7	17	16	18	64.3	83.5	76.1	5	10	24	27.7	55.6	61.3						
$7 to $8	10	13	6	50.8	72.1	64.5	9	7	12	20.0	41.7	36.8						
$8 to $9	14	11	11	42.9	62.8	60.6	4	13	10	6.2	32.0	24.5						
$9 to $10	16	24	9	31.8	54.9	53.5		9	9		13.9	14.3						
$10 to $12	14	26	21	19.1	37.8	47.7		1	4		1.4	5.1						
$12 to $15	8	17	36	8.0	19.2	34.1						1.0						
$15 to $20	2	6	14	1.6	7.1	10.9			1			1.0						
$20 to $25		2	1		2.8	1.9												
$25 and over		2	2		1.4	1.3												

Shoes: Establishment No. 275.

LOCATION: Middle states.

PRODUCTS: Ladies', misses', and children's boots and shoes. The establishment has apparently abandoned the manufacture of slippers since 1900.

NORMAL WORKING TIME PER WEEK: Each period, 59 hours.

SPECIAL FEATURES: Week covered for 1905 ended July 27, 1904; for 1900, February 16; for 1890, February 14. The number of men and women has increased, while the number of children has decreased since 1900. The increase in the number of men and women has apparently been principally among those at lower weekly earnings, as the proportions at the higher earnings were slightly less for 1905 than for 1900. The use of machinery has been constantly increasing.

WEEKLY EARNINGS.	MEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						WOMEN 16 YEARS AND OVER AT SPECIFIED EARNINGS IN A WEEK.						CHILDREN UNDER 16 YEARS AT SPECIFIED EARNINGS IN A WEEK.					
	Number.			Cumulative percentage.			Number.			Cumulative percentage.			Number.			Cumulative percentage.		
	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890	1905	1900	1890
Total	351	212	92				233	128	50				39	64	23			
Less than $3	12		1	100.0	100.0	100.0	3	3		100.0	100.0	100.0	15	25	14	100.0	100.0	100.0
$3 to $4	14	16		96.6	100.0	98.9	16	7	1	98.7	97.7	100.0	24	39	9	61.5	60.9	39.1
$4 to $5	25	8	6	92.6	92.5	98.9	23	6	12	91.8	92.2	98.0						
$5 to $6	22	8	8	85.5	88.7	92.4	18	19	14	81.9	87.5	74.0						
$6 to $7	19	16	8	79.2	84.9	83.7	40	14	8	74.2	72.7	46.0						
$7 to $8	17	7	8	73.8	77.4	75.0	25	16	7	57.0	61.8	30.8						
$8 to $9	14	8	4	68.9	74.1	66.3	38	18	4	46.3	49.3	16.0						
$9 to $10	18	12	9	64.9	70.3	62.0	29	28	1	30.0	35.2	8.0						
$10 to $12	60	25	10	59.8	64.6	52.2	32	14	1	17.6	13.3	6.0						
$12 to $15	92	54	9	42.7	52.8	41.3	9	2	1	3.9	2.4	4.0						
$15 to $20	41	43	24	16.5	27.4	31.5		1	1		0.8	2.0						
$20 to $25	12	12	5	4.8	7.1	5.4												
$25 and over	5	3		1.4	1.4													

The establishment comparisons indicate that there was a much larger proportion of men in the 25 establishments in the higher groups of earnings at the census of 1905 than in 1900, and about the same percentage in the higher groups in 1900 as in 1890. The earnings of the children increased from 1890 to 1900 even more largely than from 1900 to 1905. There was a greater percentage of women at the higher amounts in 1905 than at the census of 1900.

The following statement gives the number of men, women, and children reported for the 25 establishments at the censuses of 1905, 1900, and 1890, and the percentage in establishments showing increased earnings in 1905 and 1900, respectively. It is not necessarily true that every wage-earner in each establishment participated in the increase, but only that the median for men, or women, or children was in a higher group, or that the cumulative percentage was greater in the same group than at the previous census.

Wage-earners in 25 establishments, 1905, 1900, and 1890; with percentage in establishments showing increased earnings: 1905 and 1900.

WAGE-EARNERS.	1905			1900			1890		
	In all establishments, number.	In establishments showing increased earnings.		In all establishments, number.	In establishments showing increased earnings.		In all establishments, number.	In establishments showing increased earnings.	
		Number.	Per cent.		Number.	Per cent.		Number.	Per cent.
Total	6,798	4,299	63.4	6,052	4,122	68.1	5,200	......	......
Men 16 years and over	3,945	2,539	64.4	3,500	1,908	54.5	3,022	......	......
Women 16 years and over	2,606	1,513	58.1	2,084	1,803	86.5	1,895	......	......
Children under 16 years	247	247	100.0	468	411	87.8	283	......	......

It is not a correct inference from the figures found in the establishment comparison that earnings for men in all industries increased during the decade ended with 1900 and increased still more after that date, or, from the industry comparison, that earnings for all wage-earners decreased from 1900 to 1905. Different methods were followed in collecting and compiling the statistics at the two censuses, and in the industry comparison the larger numbers considered at the census of 1905 have probably tended to increase the proportions at the lower amounts. Instructions to special agents in 1905 provided that "foremen, when performing work similar to other wage-earners, but given charge of a few workmen with little additional responsibility, and receiving slight, if any, increase in wages, are not to be included as salaried employees, even if carried on the pay rolls as foremen." Such foremen were to be included as wage-earners. The instructions to the special agents collecting wage rates in 1900 stated specifically that "officials and office force may be omitted, but all foremen should be included." It may be, therefore, that the returns for 1900 and 1890 included a number of highly paid foremen that were not included in the returns for 1905. Another explanatory factor is the possible presence of a further tendency toward the increase of low-priced labor which was discovered in some of the statistics of actual rates of wages from 1890 to 1900.[1]

While it is possible that a careful selection of establishments, in a limited number of industries, such as that made at the census of 1900, may be representative of the entire field of employment in the industries covered, it is certainly true that, when such data are placed in comparison with the results of a broader inquiry, such as that of 1905, even if conducted after the manner of the more limited investigation, there will always be more or less doubt of the accuracy of the results. And this doubt will be increased when the two inquiries are found to have been made under conditions and methods differing in important details.

[1] Twelfth Census, Employees and Wages, page xxv.

INDEX.

Acetate of lead, produced, 486; imported, 488.
Acetate of lime, produced, 401, 435, 512; exported, 437; used as material, 484, 507.
Acetic acid, produced, 401, 418, 507; establishments and uses, 418, 419.
Acetone, produced, 402, 482, 507; used as material, 476, 482, 484.
Acetylene, compression of, 480.
Acid, sludge, produced, 575, 579, 580.
Acid furnaces. *See* Open-hearth steel.
Acid phosphate, used as material, 400, 403, 509.
Acids, produced, 401; classification, 417; imported, 419; used as material, 451.
Acids, C. P., produced, 482; defined, 484.
Acker Process Co., plant, 445.
Aconite, bark, leaf, and root, imported, 485.
Adamite. *See* Corundum.
Africa, exports to, 276, 307, 367.
Agitators, use in oil refining, 579.
Agricultural implement industry, statistics of production, 129–153; summaries, 129, 131, 132–134, 136, 142–153; number, kind, and value, by states, 135, 142–153; establishments, 137, 138; patents granted, 139; exports, 139, 140; power used, 139, 621–624; wage-earners and earnings, 651, 652, 716, 724, 732, 748, 776, 778, 782, 786, 790.
Air, compressed, use in metal working machinery, 234, 235, 638.
Air, liquid, 482.
Alabama, rank in iron and steel products, 6, 7, 8, 34, 54, 67, 68.
Alaska, submarine cable system, 206; discussion relative to industries, wage-earners, and earnings, 707.
Alcohol, denatured, use in automobile motors, 279; grain and wood, used as material, 400, 463, 507–510; wood, produced, 401; used as material, 484.
Alcohol varnish, produced, 402, 461, 508, 510.
Alkaloids, produced, 402, 482, 508.
Allen, James, cable for war purposes laid by, 206.
Alternating current, power transmission, 173, 174.
Alternators, for power transmission, 163.
Alum, statistics relating to, 428–430; summaries, 428, 507; establishments, by states, 429.
Alum cake, produced, 429.
Alumina and bauxite, used as material, 445.
Aluminum, history, uses, and distribution of plants, 446, 448; production, imports, exports, and consumption, 446.
Alums, produced, 401, 429; imported, 430.
Alundum, manufacture and uses, 444, 447.
Ambulances, 312, 318, 324.
American Bell Telephone system, telephone cable requirements, 205.
American Chemical Society, committee on quality of reagents, 484.
American Iron and Steel Association, report, 54.
American Railway Association, regulations for transportation of explosives, 473.
American River Electric Co., plant, 634.
American Steel Wire Co., record run of blast furnace, 40.
American Telephone and Telegraph Co., increase in number of stations, 192.
Ammonia, aqua, used as material, 400, 423, 470, 479, 480, 486, 487, 507, 509; imports, 488; anhydrous, produced, 402, 479, 508; use in artificial refrigeration, 480; C. P., produced, 482; carbonate, muriatic or salammoniac, and sulphate, imports, 488; liquor, used as material, 480, 486; used in coke industry, 523; method of production, 540. *See also* Nitrate of ammonia.
Ammonia alum, produced, 429.
Ammonia-soda process, description and establishments using, 422, 423.
Ammoniated fertilizers, produced, 401.
Ammoniated super phosphates, produced, 438, 509.
Ammoniates, used as material, 440, 509.
Ammonium nitrate, used as material, 473, 480; produced, 486; salts, imports, 526; sulphate, used as material, 400, 440, 480, 507, 509; production and uses, 523, 540.
Ammunition industry, establishments, wage-earners, and earnings, 716, 724, 732.
Anchors and chains, iron and steel, 348; wooden, 350, 353.
Anderson Fertilizer Co., chamber process plant, 411.
Aniline, colors, used as material, 451; salts, imports, 457.
Animas Canal Reduction Water Power and Development Co., plant, 634.
Annunciators and clocks, electric, statistics relating to production and uses, 207, 208.
Anthracite coal, used as fuel in production of pig iron, 29, 44; tin and terne plate dipping and black plate, combined industry, 89; tin and terne dipping, 91.
Anthracite coal and culm, used as fuel in iron and steel industry, 12, 28, 43, 52, 71, 74, 80.
Anthracite furnaces, number and capacity, by states, 38, 39.
Apatite, imported, 441.
Arc lamp carbons, 180, 183.
Arc lamps, value of product, 161; open and inclosed, compared, 180; produced, 181; Bremer, 181, 182; Blondel, 182; magnetite, 182.
Arc lamps and searchlights, statistics relating to production and uses, 180–183.
Argentiferous ores, lead smelting, produced, 115, 117, 119; establishments, 117; by states, 118; gross and net values, 120; summary, 121.
Argentina, exports to, 139, 307.
Argols, used as material, 400, 487, 507; imports, 488.
Armor plate and gun forgings, produced, 53, 56; establishments, 56.
Armour Fertilizer Co., chamber process plant, 411.
Arsenic, produced, 115, 119.
Arsenic compounds, imports, 409.
Artificial feathers and flowers industry, establishments, wage-earners, and earnings, 716, 724, 732.
Artificial limbs industry, establishments, wage-earners, and earnings, 716, 724, 732.
Artificial stone industry, establishments, wage-earners, and earnings, 716, 724, 732.
Artists' materials industry, establishments, wage-earners, and earnings, 716, 724, 732.
Ash, use in automobile manufacture, 280.
Asia, exports to, automobiles and automobile parts, 276; steam railroad, passenger, and freight cars and parts, 367.
Atlanta Water and Electric Power Co., plant, 634.
Atlantic Coast and Gulf district, shipbuilding operations, 338, 339.
Atmospheric Products Co., production of nitric acid by electricity, 414.
Audion receiver, wireless telegraphy, 203, 204.
Austin, W. W., motor bicycle manufactured, 291.
Autocoherers or detectors, wireless telegraphy, 203.
Automatic attachments, metal working machinery, 233–235.
Automatic multiple-spindle, development and description, 234.

Automobile bodies and parts. *See* Automobiles.
Automobiles, statistics relating to manufacture, classes, and power, 168, 268–285; comparative summary, 269; by states, 270; number and value, by class and power, 272, 273; rank of states in production, 273; power, 274; summary for cities, 274; bodies and parts, 275; imports and exports, 275, 277; historical and descriptive, 277, 280; detailed summary, 282–285; built by carriage and wagon manufacturers, 304, 314, 320, 326; establishments, wage-earners, and earnings, 716, 724, 732.
Automobiles, hydrocarbon, magneto-ignition apparatus used, 215, 216.
Awnings, tents, and sails industry, establishments, wage-earners, and earnings, 716, 724, 732.
Axle grease industry, establishments, wage-earners, and earnings, 716, 724, 732.
Axles and springs, used in manufacture of carriages and wagons, 304, 310.

Babbitt metal and solder industry, establishments, wage-earners, and earnings, 716, 724, 732.
Baekeland, Dr. L. H., on manufacture of alkaline hydropides and chlorine, 449.
Bag industry, establishments, wage-earners, and earnings, 716, 724, 732.
Baking and yeast powder industry, establishments, wage-earners, and earnings, 716, 724, 732.
Barb wire. *See* Wire and wire products.
Barges, launched by private shipyards, 338, 339; statistics relating to, 340, 341; iron and steel, and wooden, 340; number, tonnage, and value, by states, 341.
Barium dioxide, used as material, 442.
Bark, used as material, 511.
Barker, George F., crude petroleum, fractional distillation, 578.
Barks and extracts, exports, for tanning, 460; medicinal, imports, 485.
Bars and rods, produced, 53, 54.
Bartlett, E. O., process for manufacturing sublimed white lead, 464.
Barytes, natural and artificial, used as material, 463; how obtained, 465; summary, 508, 510.
Base bullion, used as material, lead refining, 115, 116, 119, 121; lead contents, 118.
Basic furnaces. *See* Open-hearth steel.
Basic open-hearth steel, used as material, domestic black plates, 89, 91; tin and terne plate, by states, 97.
Basic pig iron, establishments and quantity, by states, 32, 74; blast furnaces, 74.
Basic steel ingots and castings, quantity and value, by states, 66, 67.
Basin and Plateau division, discussion relative to industries, wage-earners, and earnings, 703–705. *See also* Geographic divisions.
Baskets, and rattan and willowware industry, establishments, wage-earners, and earnings, 716, 724, 732.
Bath Iron Works, steel battle ships built by, 337.
Batteries, storage and primary, value of product, 176; discussion relating to production and use, 176–179.
Bauxite, imported for consumption, 430; deposits, 446; uses, 447; used as material, 507.
Bean pullers, 137, 144, 150.
Bean separators, 136, 144, 150.
Beehive ovens. *See* Ovens.
Beet sugar, rank of Pacific division in production, 705.
Beet sugar industry, establishments, wage-earners, and earnings, 649, 716, 724, 732.
Beilby, George, report on the cyanide industry in Europe, 434.
Belgian ovens. *See* Ovens.
Bell telephone system, exchange service furnished by, 192; number of exchanges, miles of wire, number of employees, and daily average of exchange connections, 193; copper wire in use by, 204.
Bells industry, establishments, wage-earners, and earnings, 716, 724, 732.
Belting and hose industry, establishments, wage-earners, and earnings, 716, 724, 732.
Belton Power Company, plant, 634.
Benz, Carl, application of gas engines to road vehicles, 277.
Benzine, distillation from coal tar, 432; used as material, 463; deodorized, uses of, 580.
Bermuda, exports of automobiles and automobile parts to, 276.
Bessegés, France, Siemens or Simon-Carvés oven operated, 534.
Bessemer converters, number and capacity, by states, 64; summary, 82.
Bessemer pig iron, malleable, definition, 31; establishments and production, by states, 32, 74.
Bessemer steel, rails and structural shapes, 52, 54; black plates, 53, 55, 56; ingots, 63; castings, 64. *See also* Black plates.
Bessemer steel converters, establishments and capacity, 14, 15, 61, 80; ingots and castings, by states, 63, 64; discussion relative to production, 64, 65.
Bessemer steel works, number, equipment, and capacity of establishments, and quantity and value of ingots and castings, by states, 64.
Betts, Anson G., electric conductor constructed by, 449, 450.
Biborate of soda (borax), produced, 401.
Bicarbonate of soda, produced, 401, 421; summary, 507.
Bichromate of soda, imported, 488.
Bicycle and tricycle industry, establishments, wage-earners, and earnings, 716, 724, 732.
Bicycles and tricycles, section by Robert H. Merriam, 289–297; growth and decline of industry, 289; products, 289; comparative summaries, 289, 291; active establishments, by states, 290; value of exports, 291.
Bicycles, motor, first use in United States, 291; Copeland steam, description, 292; number and value, 289, 290.
Billiard table and materials industry, establishments, wage-earners, and earnings, 716, 724, 732.
Birkeland and Eyde, process for nitric acid extraction, devised by, 414.
Bisulphites, produced as bleaching materials, 441.
Bituminous coal, used as material, 89, 91.
Bituminous coal and slack, used as fuel in iron and steel industry, 12, 28, 43, 52, 71, 74, 80; in black plate industry, 95.
Black plate industry, comparative summary and statistics of establishments, 87, 88, 94, 95; products, by states, 95; materials used, 95.
Black plates, for tinning, produced, 53, 55; establishments reporting, 55, 56; domestic and foreign, used as material, 89, 91; production, 94; by states, 95, 96; summary, 97.
Blacking industry, establishments, wage-earners, and earnings, 716, 724, 732.
Blanc fixe, how obtained, 465.
Blast furnaces, charcoal, comparative summary, 46; capital, 47; materials used, 47; pig iron produced, 48; number completed, 48.
Blast furnaces, mineral fuel, statistics, 41–45; pig iron produced, 44; establishments and value per ton, 45.
Blast furnaces, products, 3, 14, 21, 29–36; capital, 8, 10, 28; wage-earners, 11, 25; fuel, 12; materials used, 13, 28, 29; establishments, 14, 26, 28, 37; comparative summary, by geographic divisions, 16, 19; capital and products, 20; statistics concerning production of pig iron, 24–48; earnings, comparative summaries, 25, 27; production per wage-earner, 25, 41; products, classified according to kind of fuel used, 29; equipment and production, 36–40; according to kind of fuel used, by states, 38, 39; average daily capacity, 39; power, 40, 41, 621–624, 628; detailed summary, 72, 83; earnings of wage-earners, 651, 662, 666, 758, 774, 786, 788, 790.
Blasting powder, produced, 468, 509.
Blauvelt, on designers of ovens, 534.
Bleach, high-grade, production by Niagara plant, 449.
Bleaching materials, produced, 402, 441, 442, 507; discussion of statistics, 441–443; components, 442; establishments, 442.
Bleaching powder, Hasenclever on world's production, 442; used as material, 442; produced by Germany, 442, 443.
Blister, German, and miscellaneous steel furnaces, establishments, 80–82.
Blister or anodes used as material, 105, 107, 108, 110; establishments reporting, states and territories, 106; summary, 112.
Block signals, operation, by electro-pneumatic process, 481.
Blocks, used as material in iron and steel shipbuilding, 348; wooden ship and boat building, 350–353.
Blooms, billets, etc., produced in forges and bloomeries, 71.

Blooms and bar iron, production, 71.
Blue vitriol, quantity of copper contents, 103; produced in copper refining, 105, 107; used as material, 107, 110; establishments, 108, 111; by states and territories, 109; summary, 113; produced in lead smelting, 115, 508; imports, 489.
Bluing industry, establishments, wage-earners, and earnings, 716, 724, 732.
Boats, small, under 5 tons, statistics of, 333–335; motor, growth of industry, 333; canal, launched by private shipyards, 338, 339.
Boiler and other plates and sheets, produced, 53, 55; states reporting, 55.
Bolivia, ores, reexported to, 122.
Bolt, nut and pipe threading and tapping machines, produced, 227, 229.
Bolt headers, for forging hot metal, 230.
Bolts, nuts, forged spikes, washers, etc., statistics of, 59, 60; establishments, wage-earners, and earnings, 718, 726, 736.
Bone, ivory, and lamp black, summary, 507; establishments, wage-earners, and earnings, 716, 724, 732.
Bone and boneblack, used as material, 487.
Bone dust, imported for consumption, 441.
Bones, used as material, 507.
Bones, tankage, and offal, used as material, 400, 440, 509.
Bookbinding and blank book making industry, establishments, wage-earners, and earnings, 716, 724, 732, 784.
Boosters, dynamotors, and motor generators, states reporting, 166.
Boot and shoe cut stock, findings and uppers, establishments, wage-earners, and earnings, 716, 724, 732.
Boot and shoe industry, power employed, 621–623; change in process of manufacture, 624, 625; wage-earners and earnings, 651, 716, 724, 732; discussion of industry, 654–656; establishments, wage-earners, and earnings, by states, territories, and geographic divisions, 748, 749; in specified states, 774, 775, 780–791; rubber, 774, 780.
Boracic acid, imports consumed, 419.
Borates of lime or soda, imported for consumption, 425.
Borax industry, development and processes of production, 424, 425; imports, 425; production, 507.
Boring and drilling machinery, products, 227, 228; rank of specified states in manufacture, 228.
Boring and turning mills, or vertical lathes, produced, 227, 229.
Bornite, formula, 407; as a sulphuric acid producer, 408.
Boston, Mass., rank in piano manufacture, 243; pipe organs, 246; navy yard, steel training bark built at, 337.
Bowker Fertilizer Co., chamber process plant, 411.
Box cars, built for freight service, 366.
Box industry, cigar, fancy and paper, wooden packing, establishments, wage-earners, and earnings, 716, 724, 732; fancy and paper, in specified states, 784.
Boxes and nails, used as material, 89, 91, 97.
Bradley, aluminum patent granted, 446.
Bradley and Lovejoy, patents granted, 414.
Brakes, four-wheeled, 312, 318, 324.
Brantley, A. P., Sons and Co., chamber process plant, 411.
Brass, castings, and finishing, industries, establishments, wage-earners, and earnings, 716, 724, 732.
Brass and copper, rolled, industry, establishments, wage-earners, and earnings, 716, 724, 732; in specified states, 774.
Brassware, industry, establishments, wage-earners, and earnings, 716, 724, 732; in specified states, 774.
Brayton engine, kerosene first employed in, 572.
Bread and other bakery products, industry, establishments, wage-earners, and earnings, 716, 724, 732; in specified states, 774–776, 780–788.
Bremer, Hugo, description of arc lamp introduced by, 181.
Brick and tile industry, establishments, wage-earners, and earnings, 716, 724, 732; in specified states, 776–778, 784–790.
Brine, used as material, 487.
British Australasia, exports to, 139.
British Columbia, ores imported for consumption and reexported to, 122.
Bromides, produced, 482.
Bromine, imports consumed, 485.
Bronze casting industry, establishments, wage-earners, and earnings, 716, 724, 732.
Brooklyn, N. Y., navy yard, battleship built at, 337.
Brooms and brushes industry, establishments, wage-earners, and earnings, 716, 724, 732.
Broughams, 312, 318, 324.
Buckboards, 312, 318, 324.
Buffalo, N. Y., statistics of automobile manufacture, 274.
Buggies, 312, 318, 324.
Bureau of Engraving and Printing, mercury vapor lamps in use, 188.
Bureau of Standards, established for chemical tests, and instrument standardization, 485.
Burnt alum, produced, 429.
Bussey and Sons, chamber process plant, 411.
Butter, and butter reworking, industries, establishments, wage-earners, and earnings, 716, 724, 732.
Button industry, establishments, wage-earners, and earnings, 716, 724, 732.

Cables, underground, for electric lighting and power work, 204; insulation, materials used, 205, 206.
Cabooses, steam railroad, 366.
Cabriolets, 312, 318, 324.
Cabs, 312, 318, 324.
Cahill, Dr. Thaddeus, telephonic system of music production, 198.
Calcined magnesia, produced, 479.
Calcium carbide, production and uses, 445–448.
Calcium chloride, produced, 486, 487.
Calcium cyanide, manufacture, 434.
Calcium light industry, establishments, wage-earners, and earnings, 716, 724, 732.
California Gas and Electric Co., plant, 634.
Calomel, imported, 485.
Cambridge, Mass., rank in manufacture of piano materials, 250, 251.
Camphor, produced, 476, 482, 484; imported, 488.
Camwood, imported, 457.
Canada, exports to, 139, 276.
Canadian Commission, report on electric smelting of iron ore, 23, 24.
Canadian Niagara Falls Power Co., plant, 631, 634.
Canal boats, statistics, 341.
Candle industry, establishments, wage-earners, and earnings, 716, 724.
Cane mills, 137, 144, 150.
Canning and preserving industry, oysters, 649, 716, 724, 732; fish, 716, 724, 732; fruit, 716, 724, 732, 774, 780, 784.
Capital, amount invested in specified industries, iron and steel, 4–6, 8–10, 16, 18–20; blast furnace, 25, 27, 28, 41–43, 46, 47, 72, 76; steel works and rolling mills, 49–50, 76, 82; forges and bloomeries, 70; tin and terne plate industry, 87–91, 94–97; copper, lead, and zinc, smelting and refining, 101, 103, 105, 107, 110, 112–115, 119, 121–125; agricultural implements, 129, 131–132, 142, 148; electrical machinery, 158, 159, 218; musical instruments, 239–241, 252, 256, 258, 260, 264, 266; automobiles, 269, 270, 273, 275, 282; bicycles and tricycles, 289, 291, 294; carriages and wagons, 301–303, 307, 310, 316, 322; shipbuilding industry, 331, 332, 334, 335, 348, 350, 352; steam and street railroad car industry, 357, 358, 364, 365, 367, 368, 370, 371, 374, 378, 382, 389, 390; chemicals and allied products, 398, 399; acids, 404, 407, 504; sodas, 421; alums, 428; coal tar products, 430; cyanides, 432; wood distillation, 435, 505; fertilizers, 438, 494; bleaching materials, 441; electrochemicals, 444; dyestuffs, 450, 502; tanning materials, 458; paints and varnishes, 461, 463, 492, 500; explosives, 468, 470, 498; plastics, 475, 476; essential oils, 477, 506; gases, compressed and liquefied, 479; chemicals, 482, 486, 490; bone, ivory, and lampblack, 507; coke, 515, 516, 522, 528; petroleum refining, 567, 568, 575.
Car, steam and street railroad, industry, statistics, 355–393, 716, 724, 732, 774, 790.
Car axles, produced, 53, 55.
Caravans, 312, 318, 324.
Carbon dioxide, produced, 402, 479, 480, 481, 508.
Carbon tetrachloride, properties and uses, 448, 449.
Carbonate of potassium, used as material, 480.
Carbons, statistics of production, classes and uses, 161, 179, 180, 445.
Carborundum, statistics, 444–448.

Carborundum Co., current supplied to, 445.
Card cutting and designing industry, establishments, wage-earners, and earnings, 716, 724, 732.
Carnegie Steel Co., dry-air blast furnaces, 40, 45.
Carpet and rug industry (other than rag), establishments, wage-earners, and earnings, 716, 724, 732, 780, 788.
Carpets, rag, industry, establishments, wage-earners, and earnings, 716, 724, 732.
Carriage and wagon industry, scope of report, 301; establishments, wage-earners, and earnings, 301, 310, 316, 322, 651, 716, 724, 732, 750, 778, 782, 784–786; materials used, 301, 303, 307, 310, 316, 322, 327, 716, 724, 732; exports and imports, 307; production, 304–307, 312, 314, 318, 324.
Carriage bodies, used as material, 304.
Carriage hardware, lamps, and mountings, 304.
Carriages and sleds, children's, industry, establishments, wage-earners, and earnings, 716, 724, 732.
Cars, two-wheeled, pleasure, 312, 318, 324; steam railroad, establishments, wage-earners, and earnings, 357, 358, 364, 365, 371, 372, 716, 724, 732; construction and repairs, 359, 362, 367, 374–385, 774, 776, 782, 790; exported, 367; street railroad, classification, establishments, wage-earners, and earnings, 386, 716, 724, 732; construction and repairs, 387, 388, 390–393.
Carts, agricultural, 137, 144, 150; pleasure, 312, 318, 324.
Casein, use in plastics, 477.
Cash register and calculating machine industry, establishments, wage-earners, and earnings, 716, 724, 732.
Casting machines, 35.
Castings. *See* Direct castings.
Cataract Power and Conduit Co., plant, 634.
Caustic potash, method of manufacture and uses, 427.
Caustic soda, produced, 401, 421, 507, 575; imported, 425; used as material, 442, 451, 484.
Celery hillers, 136, 144, 150.
Cellarius jar, use, 418.
Celluloid, 476.
Cellulose, uses, 184, 476, 477; nitrate, per cent in dynamite, 472.
Cement industry, 628; establishments, wage-earners, and earnings, 716, 724, 732.
Central America, automobile exports to, 276.
Central station, electric measuring instruments, 213, 214.
Chalcocite, formula, 407, 408.
Chalcopyrite, formula, 407, 408.
Chamber process for utilizing sulphur gases, 409; plants, 411.
Charcoal, used as fuel, 12, 28, 47, 52, 71, 74, 80, 89, 91, 95, 403; used as material, 401, 435, 436, 470, 509; imported, 437.
Charcoal industry, establishments, wage-earners, and earnings, 716, 724, 732.
Charcoal pig iron, 46–48, 72–77.
Check rowers, 137, 144, 150.
Cheese industry, establishments, wage-earners, and earnings, 716, 724, 732.
Chemical products, 401–406, 415–419, 421–423, 426, 428–433, 435–439, 441, 442, 444, 446, 451, 458, 461, 462, 468, 469–471, 475, 477–479, 482, 483, 486, 487, 490.
Chemicals, exported and imported, 407, 419, 425, 428, 430, 434, 437, 441, 446, 450, 457, 460, 468, 475, 477, 478, 485, 488.
Chemicals and allied products, report, 397–512; scope of census and classes, 397, 398; establishments, wage-earners, and earnings, 398, 399, 404, 417, 421, 428, 430, 432, 435, 438, 439, 441, 444, 450, 458, 461, 468, 475, 477, 479, 482, 486, 490–507, 716, 724, 732, 782–784; by industries, 397, 398; used as material, 411, 440, 442, 446, 451, 456, 507, 508.
Chicago, Ill., rank in manufacture of musical instruments, 243, 246. automobiles, 274.
Children. *See* Wage-earners and wages *and* Earnings of wage-earners.
China decorating industry, establishments, wage-earners, and earnings, 716, 724, 732.
Chloral hydrate, imported, 485.
Chlorate of potash, used as material, 480.
Chloride, sulphur, uses, 450.
Chloride of lime, imported, 433.
Chloride of potassium, used as material, 509.
Chlorine, used as material, 441.
Chloroform, produced, 402, 482, 484, 508; imported, 485.
Chocolate and cocoa products industry, establishments, wage-earners, and earnings, 716, 724, 732.
Chrome tannage solution, 511.
Chromic and lactic acid, imported, 419.
Cinchona bark salts, imported, 485.
Cinchonidia, imported, 485.
Cincinnati, Ohio, rank in manufacture of metal working machinery, 226.
Circuit fittings, statistics, 214, 215.
Cities, specified, statistics of establishments manufacturing agricultural implements, 134; automobiles, 274; rank in carriage and wagon industry, 304.
Citric acid, imported, 419.
Cleansing and polishing preparations industry, establishments, wage-earners, and earnings, 716, 724, 732.
Cleveland, Ohio, rank in manufacture of metal working machinery, 226; automobile statistics, 274.
Clock industry, establishments, wage-earners, and earnings, 716, 724, 732, 774. *See also* Electric clocks and time mechanisms.
Cloth sponging and refinishing industry, establishments, wage-earners, and earnings, 716, 724, 732.
Clothing industry, men's, establishments, wage-earners, and earnings, 651, 716, 724, 734, 750, 776, 790; women's, establishments, wage-earners, and earnings, 651, 716, 724, 734, 752, 776, 780, 784–788; horse, establishments, wage-earners, and earnings, 716, 724, 734.
Clover hullers, 136, 144, 150.
Coaches, hotel, 312, 318, 324.
Coal, yield in coke, 518, 519, 521. *See also* Anthracite coal, Bituminous coal, *and* Coke.
Coal and coke, used as material, 445.
Coal and coke cars, built, 366.
Coal tar, products, 401, 432, 451, 507–511, 523–525, 530, 541; establishments, wage-earners, and wages, 430; exports and imports, 432, 457, 525; used as material, 451–455, 508, 510, 511; colors, foreign use of, 452; industry, development of, in Germany and the United States, 453–455.
Coal wagons and carts, 312, 318, 324.
Cochineal, imported, 457.
Coe, E. Frank, and Co., chamber process plant, 411.
Coffee and spice roasting and grinding industry, establishments, wage-earners, and earnings, 716, 724, 734.
Coffins, burial cases, and undertaker's goods industry, establishments, wage-earners, and earnings, 716, 724, 732.
Coke, industry, discussion relative to, 513–541; establishments, wage-earners, and earnings, 515, 516, 528, 716, 724, 734, 774, 788; produced, 518, 519, 520, 521, 524, 540; by-products, 523–525, 534; exports and imports, 525, 540; distribution, 532, 533; manufacture, 533–541; uses, 539, 540; patents, 545–563.
Coke and black naphtha, produced, 575.
Coke ovens. *See* Ovens.
Collar and cuff industry, establishments, wage-earners, and earnings, 716, 724, 734, 784.
Collodium, 507, 508, 510.
Columbia Chemical Co., ammonia-soda process, 422, 423.
Columbia Improvement Co., plant, 634.
Comb industry, establishments, wage-earners, and earnings, 716, 724, 734.
Condensed milk industry, establishments, wage-earners, and earnings, 716, 724, 734.
Condor Water and Power Co., plant, 634.
Conduits, electric, value, 206; uses, 206, 207.
Confectionery industry, establishments, wage-earners, and earnings, 718, 726, 734, 784.
Connecticut, rank in iron and steel industry, 7, 8; manufacture of electric clocks, etc., 208; metal working machinery, 227; number marine railways, 345.
Contact process, use in manufacture sulphuric acid, 409; plants, 410.
Converters, establishments using, 61, 64, 65, 80–82; synchronous, description and uses, 166.
Cooper-Hewitt, Peter, development of mercury vapor lamps, 188.
Cooperage industry, establishments, wage-earners, and earnings, 718, 726, 734.
Copeland, W. E., steam motor used by, 277.
Copeland, W. E. and L. D., "Copeland steam bicycle" invented by, 292.
Coppée oven. *See* Ovens.
Copper, lead, and zinc smelting and refining, section on, by Story B. Ladd, 99–126;

comparative summary, 101; products, 101-103.
Copper, sheets and pipe, used as material, 348, 350-353; sulphate, 489.
Copper oxide battery, 178, 179.
Copper smelting and refining, products, 60, 101-113; statistics, 101-113; establishments, wage-earners, and earnings, 103, 105-108, 110-113.
Copperas, produced, 486, 508; imports, 488; uses, 488.
Coppersmithing and sheet iron working industry, establishments, wage-earners, and earnings, 718, 726, 734.
Cordage, wire, Manila, and hemp, used as material, 348, 350-353.
Cordage and twine industry, establishments, wage-earners, and earnings, 718, 726, 734.
Cordial and sirup industry, establishments, wage-earners, and earnings, 718, 726, 734.
Cork cutting industry, establishments, wage-earners, and earnings, 718, 726, 734.
Corn cleaners, hooks, huskers, knives, and shellers, 136, 137, 144, 150.
Corset industry, establishments, wage-earners, and earnings, 649, 718, 726, 734, 774.
Corundum, forms, 444, 447.
Cotton, used as material, 470, 476, 507.
Cotton gins, presses, scrapers, and sweeps, 136, 137, 144, 150.
Cotton goods industry, power used, 620-624; establishments, wage-earners, and earnings, 651, 656-659, 718, 726, 734, 752, 774-780, 784-790.
Cotton small wares industry, establishments, wage-earners, and earnings, 718, 726, 734, 788.
Cotton waste industry, establishments, wage-earners, and earnings, 718, 726, 734.
Cottonseed, meal and oil, used as material, 400, 440, 508, 509, 510.
Coupes, 312, 318, 324.
Courtis, William M., discussion of potassium salt deposits, 426, 427.
Cramp, William, & Sons, cruisers built, 337.
Cream of tartar. *See* Tartar, cream.
Crocker, Prof. F. B., on primary batteries, 179.
Crucible, steel ingots and castings, 62; ingots, 63; castings, 64.
Crucibles industry, establishments, wage-earners, and earnings, 718, 726, 734.
Cryolite, imported, 423, 430.
Cudbear, imported, 457.
Cultivators, 135, 136, 142, 148.
Cushman, Dr. Allerton S., patent granted, 427.
Cut nail industry, decline, 58, 59.
Cut nails. *See* Nails.
Cutch, used as material, 451.
Cutlery and edge tools industry, establishments, wage-earners, and earnings, 718, 726, 734, 774.
Cyanides, produced, 401, 432-434, 507; imported, 434.
Cypress, use in automobile manufacture, 280.
Daimler, Gottlieb, application of gas engines to road vehicles, 277; bicycles, 292.
Dairymens', poulterers', and apiarists' supplies industry, establishments, wage-earners, and earnings, 718, 726, 734.
Dayton and Northern Traction Co., use of storage battery for interurban work, 177.
Decker, F. A., primary battery, 179.
De Forest, Dr. Lee, wireless telegraph detector, 203.
Delany, rapid telegraph system, 201.
De Laval, steam turbine, 628.
Delivery wagons, 312, 318, 324.
Dempwolf, C. H. and Co., chamber process plant, 411.
Denitrator, use of, in treatment of spent acids, 472.
Dentists' materials industry, establishments, wage-earners, and earnings, 718, 726, 734.
Depew, C. M., quoted as to growth of the dyestuff industry, 452.
de Rochas, M. Beau, internal-combustion engine, 278.
Detroit, Mich., statistics of automobile manufacture, 274.
Detroit Chemical Co., chamber process plant, 411.
Development and Funding Co., electrolytic alkali works, 449.
Dewey dry dock, capacity, 345.
Dextrin, burnt starch, gum substitute or British gum, imports, 457.
Dining and buffet cars, built, 366.
Dioxides, development, 443.
Direct castings, produced, iron, 29, 35; by states, 30, 33, 36, 74; steel, produced, 53, 56; by states, 61-64, 66, 67, 69, 80.
Direct current dynamos. *See* Dynamos.
Disk and cylinder records, phonograph and graphophone, value, 264.
Disston, Henry, and Sons, installation of electric induction steel furnace, 22.
Distillery products, coal tar, value, 401.
Docks, dry. *See* Dry docks.
Doctor's wagon or car, automobile, 314, 320, 326.
Dominion of Canada, carriage and wagon exports to, 307.
Door and shutter, iron and steel, industry, establishments, wage-earners, and earnings, 718, 726, 736.
Doré bars and fine bars, lead refining, used as material, 115, 117, 119, 121; contents, 118.
Double current generators, description and uses, 167.
Drays, 312, 318, 324.
Drills, agricultural, 136, 142, 148.
Drinker, Henry S., member of committee on transportation, 473.
Driving wagons, 312, 318, 324.
Drug grinding industry, establishments, wage-earners, and earnings, 718, 726, 734.
Druggists' preparations industry, establishments, wage-earners, and earnings, 718, 726, 734.
Drugs, crude, used as material, 484.
Dry-air blast, advantages, 45; gas analyses, 46.
Dry color pigments, produced, 402.
Dry colors, used as materials, 400, 463; produced, 461, 508, 510; definition of term and uses, 466.
Dry docks, number and kind, by states and geographic divisions, 344; by naval stations, 345.
Dryers, japans and liquid, preparation, 467.
Drying japans and dryers consumed, 508, 510.
Dudley, Stanton, quoted in regard to production of zinc white, 465.
Dump dirt wagons and carts, 312, 318, 324.
Dunn, Maj. B. W., chief inspector of explosives, 475.
Dunwoody, H. H. C., carborundum detector, 448.
Dupont Powder Co., contact process plant, 410.
Duryea, Charles E. and J. F., gasoline automobile constructed by, 278.
Duryea Motor Wagon Co., operations, 278.
Dutch process of white lead manufacturing, 463.
Dyeing and finishing textiles industry, establishments, wage-earners, and earnings, 634, 718, 726; classified weekly earnings, 780, 784, 788.
Dyes, alizarin, imports, 457.
Dyestuffs, statistics relating to classes, production, and consumption, 402, 450-457; comparative summary, 450; establishments and products, 451; materials used, 451; imports, 457; detailed summary, 511.
Dyestuffs and colors, produced, 476.
Dyestuffs and extracts, comparative summary, 398; detailed summary, 511; establishments, wage-earners, and earnings, 718, 726, 734.
Dyewoods, imports, 457. *See also* Dyestuffs.
Dynamite, produced, 402, 468, 471; composition, 472, 509.
Dynamo and motor supplies, 216.
Dynamo art, revolution of, 162.
Dynamos, statistics relating to production, 161-166; number, horsepower, and value, specified states, 161; alternating current, types and uses, 162-166; direct current, value in electro-chemical processes, 162; modifications in manufacture, 163.
Dynamotors. *See* Motor generators, dynamotors, and boosters.

Earnings of wage-earners, all industries, 716-741; states, territories, and geographic divisions, 742-747, 774-791; twenty-five selected industries, 748-773.
East Indies, carriage and wagon exports to, 307.
Eastern North Central division, discussion relative to industries, wage-earners, and earnings, 690-693. *See also* Geographic divisions.
Eastern South Central division, discussion relative to industries, wage-earners, and

earnings, 697-699. *See also* Geographic divisions.
Edison, T. A., storage battery invented by, 177, 178.
Edison Co., Chicago, turbo-generator built by, 165; installation of double current generators, 167; New York, electrical control equipment installed, 175, 176; extensive use of storage batteries, 177; tantalum lamps in use by, 185.
Edison copper oxide battery, 178, 179.
Edison Electric Co., plant, 634.
Electric annunciators. *See* Annunciators and clocks, electric.
Electric clocks and time mechanisms, 208.
Electric conduits, excluded from report, 157; interior, classes described, 207. *See also* Conduits, electric.
Electric cooking apparatus, adopted by hotels, 210, 211.
Electric custom work and repairing, 217; deterioration of industry, 217.
Electric Development Co., plant, 634.
Electric furnaces, future use in iron and steel industry, 22; types, 23, 24; advantages, for production of ferroalloys and crucible and high-grade steels, 24; induction for commercial operation, 24; production of nitric acid, 414.
Electric heating apparatus, statistics relating to production, cost of operation, advantages, and use, 210, 211.
Electric horsepower. *See* Horsepower.
Electric light fixtures, statistics, 190, 191; value of product, 190; improvements in design and character, 191.
Electric measuring instruments, produced, 213, 214.
Electric meters, for consumers' circuits, 213; establishments, 213; states producing, 214. *See also* Watt-hour meters.
Electric motors, distribution of power, 167; in industrial establishments, by classes, 169; summary, 619, 620. *See also* Motors, electric.
Electric railways, statistics relating to motors used, 167, 168; development of motor industry in connection, 170, 171; use of storage battery equipment, 177.
Electric signs, value and growth of industry, 217.
Electric smelting, iron ore, report of Canadian commission, 23, 24.
Electric Smelting and Aluminum Co., production of ferroalloys, 22.
Electric street cars, built, 366.
Electric street signs, effect on production of incandescent lamps, 184.
Electric switches, signals, and attachments, value and functions, 215.
Electric testing and scientific instruments, statistics, establishments, production, and value, 213, 214; growth of industry, 214.
Electric welding apparatus, development and use, 211.
Electrical Development Co., vertical turbines used, 631.
Electrical Lead Reduction Co., manufacture of electro-chemicals, 445.
Electrical machinery, apparatus, and supplies, 157-221; first complete record, 157; supplies, not including porcelain, 157; growth of industries, 157, 158; summaries, 158, 159, 218; household goods, miscellaneous, 210, 211; novelties and toys, 216, 217; transmission plants, 634; wage-earners and earnings, 651, 718, 726, 734; by states, territories, and geographic divisions, 754; by specified states, 776, 780, 784-788.
Electricity, importance in medicine and surgery, 216; factor in development of speed-changing devices, 233; distribution from Niagara Falls, 445.
Electro Metallurgical Co., production of ferroalloys, 23.
Electro-chemicals, products included, 444; process of production and distribution of establishments, 444, 450; summary, 507.
Electro-therapeutic apparatus, value, 215; establishments and states producing, 216.
Electrochemical and Metallurgical Industry, extract from, 24.
Electrolytic copper refining process, development, 162.
Electroplating, use of direct current dynamos in, 162; industry, establishments, wage-earners, and earnings, 718, 726, 734.
Electrothermic metallurgy of iron and steel, 22-24.
Elevators, electric, 167, 168.
Elkington, James, first electrolytic copper refining by, 162.
Emery-wheel industry, establishments, wage-earners, and earnings, 718, 726, 734.
Enamel, rubber, and other carriage cloth, used as material, 304.
Enameling and enameled goods industry, establishments, wage-earners, and earnings, 718, 726, 734.
Engines, gas and gasoline, number and horsepower, 619, 620; use, and development of manufacture, 635-637; gas blast furnace, utilization of, 637; steam, number and horsepower, 619, 620.
Engines and boilers, agricultural, 137, 144, 150.
Engravers' materials, industry, establishments, wage-earners, and earnings, 718, 726, 734.
Engraving, steel, including plate printing, industry, establishments, wage-earners, and earnings, 718, 726, 734; establishments, wage-earners, and earnings, 649, 718, 726, 734.
Ensilage cutters, 137, 144, 150.
Envelope industry, establishments, wage-earners, and earnings, 718, 726, 734.
Epsom salts, produced, 402, 479, 486, 508; imports, 488.
Equalizers, 137, 144, 150.
Essential oils, summaries, 398, 477, 512; produced, 402, 477; used as material, 478.
Establishments, number in specified industries, iron and steel, 4-6, 8-10, 14, 16, 18, 19; blast furnace, 25, 27, 28, 32-33, 35-37, 41-43, 46, 47, 72, 76; steel works and rolling mills, 49-51, 58, 61, 64, 66-69, 76, 82; forges and bloomeries, 70; tin and terne plate, 87-91, 93-97; copper, lead, and zinc smelting and refining, 101, 103, 105-108, 110-115, 117, 119-125; agricultural implements, 129, 131-132, 137, 138, 142, 148; electrical machinery, 158, 159, 218; musical instruments, 239-241, 252, 256, 258, 260, 264, 266; automobiles, 269, 270, 273, 275, 282; bicycles and tricycles, 289-291, 294; carriages and wagons, 301-303, 307, 310, 316, 322; shipbuilding, 331, 332, 334, 335, 347, 348, 350, 352; steam and street railroad car, 357-359, 364, 365, 367, 368, 371, 374, 378, 382, 386-390; chemicals and allied products, 398, 399; acids, 404, 405, 412, 415, 417-419, 504; sodas, 421, 422; alums, 428, 429; coal tar products, 430, 431; cyanides, 432, 433; wood distillation, 435, 436, 505; fertilizers, 438, 439, 494; bleaching materials, 441, 442; electro-chemicals, 444; dyestuffs, 450, 451, 502; tanning materials, 458; paints and varnishes, 461, 462, 492, 500; explosives, 468, 469, 498; plastics, 475, 476; essential oils, 477, 478, 506; compressed and liquefied gases, 479; chemicals, 482, 483, 486, 487, 490; bone, ivory, and lamp black, 507; coke, 515, 516, 522, 528; petroleum refining, 567, 568, 574; power employed, 619, 620.
Esters, produced, 482.
Ether, produced, 402, 482, 484, 508; consumed in establishments where manufactured, 403, 485, 508, 509; used as material, 470, 476; patent granted P. Fritzsche, 484; nitrous spirits, imports consumed, 485; petroleum, use, 580.
Europe, exports to, automobiles and automobile parts, 276; carriages and wagons, and parts, 307; steam railroad, passenger, and freight cars, and parts, 367.
Expenses, miscellaneous, in specified industries, iron and steel, 4-6, 16, 18, 19; blast furnaces, 25, 27, 41, 42, 46, 72; steel works and rolling mills, 49-50, 78; forges and bloomeries, 70; tin and terne plate, 87, 90, 91, 94-96; copper, lead, and zinc smelting and refining, 101, 103, 105, 107, 108, 110-115, 119, 121-124, 126; agricultural implements, 129, 131, 132, 142, 148; electrical machinery, 158, 159, 218; musical instruments, 239-241, 252, 256, 258, 260, 264, 266; automobiles, 269, 270, 273, 275, 282; bicycles and tricycles, 289, 291, 294; carriages and wagons, 301-303, 307, 310, 316, 322; shipbuilding, 331, 332, 335, 348, 350, 352; steam and street railroad cars, 357, 358, 364, 365, 367-371, 374, 378, 382, 386, 388-390; chemicals and allied products, 398, 399; acids, 404, 417, 504; sodas, 421; alums, 428; coal tar products, 430; cyanides, 432; wood distillation, 435, 505; fertilizers, 438, 496; bleaching materials, 441; electro-chemicals, 444; dyestuffs and extracts, 450, 502; tanning materials, 458;

paints and varnishes, 461, 463, 492–495, 500; explosives, 468, 470, 498; plastics, 475, 476; essential oils, 477, 506; compressed and liquefied gases, 479; chemicals, 482, 486, 490; bone, ivory, and lamp black, 507; coke, 515, 528; petroleum refining, 567, 575.
Explosives, summaries, 398, 468, 470, 498, 509; increase, 399; produced, 402, 468, 469; statistics relating to classes, production, and uses, 468–475; establishments, 469; used as material, 470; transportation of, 473–475; imports and domestic exports, 475.
Explosives industry, establishments, wage-earners, and earnings, 718, 726, 734.
Exports, tin plate, terne plate, and taggers tin, 92; agricultural implements, 130; metal working machinery, 226; musical instruments, attachments, etc., 242; care observed in shipping, 242; value, compared with value of domestic production, 242; automobiles, 276; bicycles, 291; carriages and wagons, 307; steam railroad passenger and freight cars, 367; wood distillation products, 437; aluminum, 446; tanning materials, 460; paints, pigments, colors, etc., 468; explosives, 475; pyroxylin plastics, 477; oils, 478; coke, coal tar, crude and pitch, 525; petroleum, 573.
Express wagons, 312, 318, 324.
Extracts, tanning material, produced, 402.

Falding, F. J., sulphuric acid plants and processes, 410; on consumption of sulphuric acid in iron and steel industry, 411.
Fancy articles industry, establishments, wage-earners, and earnings, 718, 726, 734.
Fanning mills, 136, 144, 150.
Faraday, ——, benzine discovered by, 481.
Farm trucks, 137, 144, 150.
Farm wagons, 312, 318, 324.
Fats, used as material, 451.
Federal building, Chicago, electric lighting fixtures, 191.
Federal Chemical Co., chamber process plant, 411.
Feldspar, 426, 427.
Felt goods industry, establishments, wage-earners, and earnings, 718, 726, 734.
Fencing, field, 59.
Ferroalloys, 22, 23.
Ferrocyanide, 401.
Ferromanganese, 30, 33, 74.
Ferrophosphorus, 30.
Ferrosilicon, 33, 34, 74.
Ferrotitanium works, 23.
Ferrovanadium works, 23.
Fertilizers, comparative summaries, 398, 438; produced, 438, 439, 509; discussion, 437–441; establishments, 438, 718; materials used, 440; imports, 441; detailed summary, 509; wage-earners and earnings, 718, 726, 734, 776, 788, 790.
Fessenden, Prof. R. A., inventor wireless telegraph detector, 203.
Fifth International Congress of Applied Chemistry, report on cyanide industry, 434.
Files industry, establishments, wage-earners, and earnings, 718, 726, 734.
Fillers, paint and varnish, 467, 508, 510.
Fine chemicals, produced, 402, 482, 508; establishments, 483; used as material, 484; imports, 485.
Fine color pigments, produced, 402.
Fine colors, produced, 461, 508.
Firearms industry, establishments, wage-earners, and earnings, 718, 726, 734.
Fire extinguishers industry (chemical), establishments, wage-earners, and earnings, 718, 726, 734.
Fire patrol wagons, 312, 318, 324.
Fireworks industry, establishments, wage-earners, and earnings, 718, 726, 734.
Fish, used as material, 400, 440, 509.
Flags and banners industry, establishments, wage-earners, and earnings, 718, 726, 734.
Flaming, or luminous arc lamps. *See* Arc lamps.
Flash point, minimum for United States Army, 581.
Flat cars, steam and street railroad, 366.
Flat irons and curling irons, electric. *See* Electric heating apparatus.
Flavoring extract industry, establishments, wage-earners, and earnings, 718, 726, 734.
Flax and hemp, dressed, industry, establishments, wage-earners, and earnings, 649, 718, 726, 734.
Flour and grist mill industry, power used, 620–623; products, value, 693; establishments, wage-earners, and earnings, 718, 726, 734, 778, 782.
Fluxes, used as material, 13, 28, 43, 47, 72.
Food preparations, industry, establishments, wage-earners, and earnings, 718, 726, 734.
Fore River Shipbuilding Co., steel battle ships built, 337.
Forge pig iron, establishments, 33; produced, 33, 74.
Forges and bloomeries, active and idle establishments, capital, 9, 70; wage-earners, 11; fuel, 12; materials used, 13; equipment and products, 14; discussion relating to, 70, 71.
Forging, iron and steel industry, establishments, wage-earners, and earnings, 718, 726, 736.
Forging machines, 227, 230.
Foundry, pig iron, establishments, 32, 34, 74.
Foundry and machine shop industry, agricultural implements manufactured, 138; establishments, wage-earners, and earnings, 651, 718, 726, 734, 754, 774–790.
Foundry supplies industry, establishments, wage-earners, and earnings, 718, 726, 734.
France, exports of agricultural implements to, 139.
Frank, A., potassium chloride extraction, patents, 426.
Frank and Caro, calcium cyanamid manufacture, 434, 448.
Frasch, Herman and Hans, ammonia-soda process, 422.
Freight, cost of, in specified industries, blast furnaces, 74; steel works and rolling mills, 80; copper smelting and refining, 112; lead smelting and refining, 120, 121; zinc smelting, 126; agricultural implements, 148; musical instruments, 252, 256, 261, 266; carriages and wagons, 312, 318, 324; steam and street railroad car, 371, 374, 378, 382, 389; chemicals and allied products, 400, 507–512; coke, 528; petroleum refining, 575; shipbuilding, 352.
Fritzsche, P., patent for ether production, 484.
Fruit cars, steam railroad, built, 366.
Fuel, used in specified industries, iron and steel, 12, 540; blast furnaces, 29, 35, 38, 39, 41–45, 74; steel works and rolling mills, 52, 80, 540; tin and terne plate, 89, 91, 95, 97; copper smelting and refining, 112; lead smelting and refining, 121; zinc smelting, 126; agricultural implements, 142, 148; electrical machinery, apparatus, and supplies, 218; musical instruments, 252, 256, 258, 260, 266; automobiles, 282; bicycles and tricycles, 294; carriages and wagons, 304, 312, 318, 324; shipbuilding, 348, 352; steam and street railroad car industry, 371, 374, 378, 382, 390; chemicals and allied products, 400, 507–512; coke, 528; petroleum refining, 569, 575.
Fuller, Myron L., on source of carbon dioxide, 481.
Fulton, John, beehive ovens designed by, 533; quoted on the structure of coke, 539.
Fur goods industry, establishments, wage-earners, and earnings, 718, 726, 734.
Furnaces. *See* Anthracite furnaces, Blast furnaces, Electric furnaces, *and* Open-hearth steel.
Furnishing goods, men's, industry, establishments, wage-earners, and earnings, 718, 726, 734.
Furniture cars, steam railroad, built, 366.
Furniture industry, establishments, wage-earners, and earnings, 651, 718, 726, 734, 756, 776, 790.
Furniture vans and wagons, 312, 318, 324.
Fusel oil, refined, 482; used as material, 484.
Fuses, electric, 212, 213.
Fuses and lightning arresters, statistics, 211–213; produced, 212.
Fustic, used as material, 451; imports, 457.
Fustic extract, used as material, 451.

Galenite, formula, 407; value as a sulphuric acid mineral, 408.
Galvanizing industry, establishments, wage-earners, and earnings, 649, 718, 726, 734.
Gambier or terra japonica, imports consumed, 457.
Garbage wagons and carts, 312, 318, 324.
Gardening implements, 144, 150.
Gary, Ind., steel works, motors in use, 169, 170.
Gas, illuminating, produced, 479.
Gas, illuminating and heating, industry, establishments, wage-earners, and earnings, 649, 718, 726, 734, 784. *See also* Natural gas.
Gas, surplus in coke industry, 523.

Gas and lamp fixture industry, establishments, wage-earners, and earnings, 718, 726, 734.
Gas Engine and Power Co., and Chas. L. Seabury Co., Consolidated, gunboats built, 337.
Gas machines and meters industry, establishments, wage-earners, and earnings, 718, 726, 734.
Gases, compressed and liquefied, produced, 402, 479, 508; manufacture, 478, 482; establishments, wage-earners, and earnings, 479.
Gasoline, uses, 580.
Gayley dry-air blast, discussion of, 45.
Gayley, James, application of dry-air blast to manufacture of iron, 480.
Gears, used as material in carriage and wagon manufacture, 304, 310, 316, 322.
Geber, on nitric acid production, first description in chemical history, 412; muriatic acid, 417; acetic acid, 418.
General Chemical Co., contact process plant, 410.
General chemicals, produced, 402; definition, 485; discussion, 485–489.
Generators, double current, 167.
Geographic divisions, industries shown by, iron and steel, 16, 20, 21; agricultural implements, 131, 132; carriages and wagons, 302, 303; shipbuilding, 337, 344, 346; steam and street railroad cars, 364, 367, 388; chemicals and allied products, 406, 416, 418, 422, 439, 462, 469, 478, 479, 483, 487; power employed in manufactures, 625; earnings of wage-earners, 654, 656, 660, 663, 666, 667, 670, 672, 678, 679, 683, 684, 686–689, 691, 692, 694, 695, 697, 698, 700–705, 710–715, 742–773.
Georgia Chemical Works, chamber process plant, 411.
Germany, exports to, agricultural implements, 139; coal tar products, 432; bleaching powder products, 442, 443; coal tar industry in, 453.
Gigs, 312, 318, 324.
Glass cutting, staining, and ornamenting industry, establishments, wage-earners, and earnings, 718, 726, 734.
Glass industry, sodas used, 423, 424; potash or pearlash, 427; wage-earners and earnings, 651, 659–662, 718, 726, 734; by specified states, 758, 776, 778, 784, 786.
Glauber's salt, produced, 486; imports, 489.
Gloves and mittens, leather, industry, establishments, wage-earners, and earnings, 718, 726, 734.
Glucose industry, establishments, wage-earners, and earnings, 718, 726, 734.
Glue industry, establishments, wage-earners, and earnings, 718, 726, 734.
Glycerin, used as material, 400, 470, 487, 507, 509; produced, 402, 470, 486; imports, 488.
Goethe, on saving volatilized matter, 534.
Gold, product, copper and lead, smelting and refining industry, 102; copper, smelting and refining, 105, 107–110, 112, 113; lead, smelting and refining, 115, 117–122; establishments reporting gross and net values, 120; imports and exports, 122; used as material, in fine chemicals, 484.
Gold and silver leaf and foil industry, establishments, wage-earners, and earnings, 718, 726, 734.
Gold and silver reducing and refining (not from ore) industry, establishments, wage-earners, and earnings, 718, 726, 734.
Gold salts, produced, 402, 482, 508.
Goldschmidt, Hans, production of alumina, 447.
Gondolas, steam railroad, built, 366.
Government Printing Office, electric motors used, 170; direct current switchboard, 175; electric heating equipment, 211.
Government shipyards. *See* Shipyards, Government.
Governmental establishments. *See* Shipbuilding industry.
Grain cradles, 136, 144, 150.
Grain sowers, 136, 142, 148.
Graphite, and graphite refining, industry, establishments, wage-earners, and earnings, 718, 726, 734. *See also* Electrochemicals.
Graphophones. *See* Phonograph and graphophone industry.
Graselli Chemical Co., chamber process plant, 411.
Gray, Prof. Elisha, submarine telephone signalling system, 199.
Grease, from petroleum, method of manufacture, 582.
Grease and tallow industry, establishments, wage-earners, and earnings, 718, 726, 734.
Great Lakes district, shipbuilding in, 335, 338, 339.
Great Northern Power Co., transformers built, 174; plant, 634.
Greely, Gen. A. W., Chief Signal Officer, United States Army, 206.
Greenville Fertilizer Co., chamber process plant, 411.
Greisheim process, nitric acid condensation, 413.
Griffith and Boyd, chamber process plant, 411.
Grinding and polishing machines, produced, 227; by states, 229.
Grindstone industry, establishments, wage-earners, and earnings, 718, 726, 734.
Ground and chipped wood, tanning materials, produced, 402, 458; dyestuffs, produced, 451, 511.
Ground bark, leaves, roots, and wood, dyestuffs, consumed as material, 511.
Grubbing machines, 144, 150.
Guano, imports, 441.
Guantanamo, Cuba, war cable laid, 206.
Gums, used as material, 400, 463, 508, 510.
Gums and dextrin, dyestuffs, produced, 451, 511.
Gun cotton, or pyroxylin (explosive), produced, 402, 468; per cent of nitric and sulphuric acid in, 416.
Gunpowder, produced, 402, 468, 470, 509; census classification, 471; imports and exports, 475.
Gutta-percha, for submarine cables, 206.
Guttmann, on chamber process for sulphuric acid production, 409; nitric acid condenser, 413.
Gypsum wall plaster industry, establishments, wage-earners, and earnings, 718, 726, 734.

Hacks, 312, 318, 324.
Hairwork industry, establishments, wage-earners, and earnings, 718, 726, 734.
Hamilton Cataract Power and Light Co., plant, 634.
Hammered scrap blooms and imported Swedish billets and bars, used as materials, 13, 52, 78.
Hammers, steam, power, and drop, produced, 227, 230.
Hammock industry, establishments, wage-earners, and earnings, 718, 726, 734.
Hand carts, agricultural, 137, 144, 150; business, 312, 318, 324.
Hand knit goods industry, establishments, wage-earners, and earnings, 718, 726, 734.
Hand stamp industry, establishments, wage-earners, and earnings, 718, 726, 734.
Hansoms, public, 312, 318, 324.
Hard or antimonial lead production, 114, 115, 117, 119; establishments, 117; by states, 118; summary, 121.
Hardware industry, establishments, wage-earners, and earnings, 718, 726, 736, 774.
Hardware, saddlery, industry, establishments, wage-earners, and earnings, 718, 726, 736.
Harkins, W. D., on industrial value of smelter smoke, 408.
Harrison Bros. Co., contact process plant, 410.
Harrows, 135, 136, 144, 150.
Hart's nitric acid condenser, construction, 413.
Harvesters, headers, and binders, 135, 136, 144, 150.
Harvesting implements, value, by states, 135; summaries, 136, 144, 150; establishments reporting, 137, 138.
Hasenclever, ——, on world's production of bleaching powder, 442.
Hat and cap industry, straw and wool, establishments, wage-earners, and earnings, 718, 726, 736.
Hat and cap materials industry, establishments, wage-earners, and earnings, 718, 726, 736.
Hats, felt, straw, and wool industry, establishments, wage-earners, and earnings, 718, 726, 736, 774, 784.
Hay and bale ties, 59.
Hay carriers, 136, 137, 144, 150.
Hay cutters, 137, 144, 150.
Hayes, S. Dana, method of producing burning oils, 572.
Hayforks, 135, 136, 144, 150.
Hay loaders, 136, 137, 144, 150.
Hay presses, 137, 144, 150.
Hayracks, 137, 144, 150.
Hayrakes, 136, 137, 144, 150.

Hay stackers, 136, 137, 144, 150.
Hay tedders, 136, 137, 144, 150.
Hearses, 312, 318, 324.
Hemlock bark, imported, 460; used as material, 559.
Hemlock extract, produced, 458, 511; imported, 460.
Héroult electric furnace, description and product, 22, 23.
Hickory, use in automobile manufacture, 280.
High speed steel, invention, effect on metal-working machinery industry, 232.
High tension cables, development, 205.
Hildreth, Doctor ——, filtration of petroleum for medicinal use, 577.
Hoes, 136, 137, 144, 150.
Holcomb Steel Co., installation of Héroult electric furnace, 22.
Holyoke, Mass., Water Power Co., switchboard equipment, 175.
Hones and whetstones industry, establishments, wage-earners, and earnings, 649, 718, 726, 736.
Hoops, bands, cotton ties, and skelp, iron and steel, produced, states reporting, 53–55.
Horizontal turbo-generators. *See* Turbo-generators.
Horse cars, 366.
Horse hayforks, 135–137.
Horse hayrakes, 135–137.
Horse nails. *See* Nails.
Horsepower, summary, 619; idle establishments reporting, 620; by industries, 622, 623; per wage-earner, 624; by geographic divisions, 625. *See also* Power.
Horsepowers, agricultural, 137, 144, 150.
Horseshoe industry, establishments, wage-earners, and earnings, 718, 726, 736.
Hose wagons, 312, 318, 324.
Hosiery and knit goods industry, power employed, 621–624; establishments, wage-earners, and earnings, 651, 718, 726, 736, 758, 774, 776, 780, 790.
Hotels, adoption of electric cooking apparatus by, 210.
House furnishing goods industry, establishments, wage-earners, and earnings, 718, 726.
Hydraulic energy, utilization and conversion, in transmission plants, 635.
Hydriodate, iodide, and iodate of potash, produced, 485.
Hydrogen, liquid and compressed, use of, 481, 482.
Hydrogen dioxide, bleaching material, produced, 441.
Hypochlorites, produced, 402, 441, 507.

Ibbotson, S. E., report on Kjellin furnace, 24.
Ice, manufactured, establishments, wage-earners, and earnings, 718, 726, 736.
Ice wagons, 312, 318, 324.
Illinois, rank in iron and steel industry, 6–8, 51, 54, 59, 62, 67, 68; agricultural implements, 133, 136; electrical machinery and appliances, 193, 207, 208, 214; musical instruments, 242, 243; steam and street railroad cars, 364.
Implements, cultivation. *See* Agricultural implements.
Imports, for consumption, in tin and terne plate industry, 92; musical instruments, attachments, and materials, 242; carriages and wagons, 307; chemicals and allied products, 407, 419, 425, 428, 430, 432, 434, 437, 441, 446, 450, 457, 460, 468, 475, 477, 478, 485, 488; coke, 525, 526; petroleum refining, 574.
Incandescent lamp signals, used in telephony, 194.
Incandescent lamps, statistics of production, 161, 183–190.
Independent telephone system, service, 192, 193.
Indiana, rank in production of bars and rods, 54; agricultural implements, 136; electrical machinery and appliances, 177, 193, 214; steam railroad cars, 364.
Indianapolis, Ind., statistics of automobile manufacture, 274.
Indigo, used as material, 451, 511; imports, 457.
Induction motors. *See* Motors, electric.
Industries, analysis of earnings in selected, 648–812.
Ingots, blooms, billets, etc., iron or steel, establishments, 14, 61, 69, 71, 77–79; used as material, 13, 52, 78, 89, 95; produced, 52, 53, 56, 61, 63, 64, 66, 67, 69, 71, 80.
Ingots, wire, bars, etc., copper, establishments and production, 105, 107–110, 113.
Ink, printing and writing, industry, establishments, wage-earners, and earnings, 718, 726, 736.
Instruments, professional and scientific, industry, establishments, wage-earners, and earnings, 718, 726, 736.
Insulated metal, use in interior electric conduits, 207; wires and cables, produced, 159, 161, 204–206.
Insulating, materials, 217.
Interborough Railway System, New York, push-button control system used, 175.
Interborough Rapid Transit plant, New York, turbo-generators used, 165.
Interborough Subway System, New York, motive power equipment, 171.
Interchangeable tools, 235, 236.
International Acheson Graphite Co., 445.
International Electrical Congress, section devoted to electro-therapeutics, 216.
Inter-pole motors, 170.
Interurban railway systems, equipment and operation, 171–173.
Iodides, produced, 482.
Iodine, imports, 485.
Iodoform, imports, 485.
Iron and steel industry, discussion, 3–71; establishments included, 3; comparative summaries, 4–6; product by states, 7; establishments, 8, 14, 15, by states, 9, 10; wage-earners, by branches, 11; fuel consumed, 12; materials used, 13; production, discussion, 13–14; by geographic divisions, 15–22; in New England and Middle states, 21, 22; electrothermic metallurgy, 22–24; power used,' 620–624; establishments, wage-earners, and earnings, 718–720, 726–728, 736.
Iron liquor dyestuffs, produced, 451, 511.
Iron ore, electric smelting of, 23, 450; used as material, 13, 28, 43, 47, 52, 71, 72, 80, 89, 95.
Iron oxides, and other earth colors, produced, 402, 461, 466, 508, 510; used as material, 463.
Iron sulphate, imported, 488.
Ivory and bone work industry, establishments, wage-earners, and earnings, 720, 728, 736.
Ivory and keys, piano, 250; organ, 251.
Ivoryton, Conn., rank in manufacture piano materials, 250, 251.

Jackson Fertilizer Co., chamber process plant, 411.
Japan lacquers, and liquid dryers, 402.
Japanning industry, establishments, wage-earners, and earnings, 720, 728, 736.
Jarecki Chemical Co., chamber process plant, 411.
Jewelry and instrument case industry, establishments, wage-earners, and earnings, 718, 728, 736.
Jewelry industry, establishments, wage-earners, and earnings, 720, 728, 736, 780, 788.
Juniata Hydro-Electric Co., plant, 634.
Jute and jute goods industry, establishments, wage-earners, and earnings, 720, 728, 736.

Kainit, used as material, 400, 440, 509.
Kalamazoo, Mich., statistics of automobile manufacture, 274.
Kalsomine. *See* Paints and varnishes.
Kaolin and ground earth industry, establishments, wage-earners, and earnings, 720, 728, 736.
Keller furnace, description, 22, 23.
Kentucky, rank in value of iron and steel products, 7, 8; production of ferrosilicon, 34.
Kerosene, 572.
Kieserite, kyanite, or cyanite and kainite, imported for consumption, 441.
Kjellin furnace, production, 22, 24; description, 23, 24.
Knab-Carvés by-product oven, 534.
Kneitsch process, sulphuric acid extraction, 409.
Köchst process, sulphuric acid extraction, 409.
Krupp Works, electric induction furnace used, 24.

Labels and tags industry, establishments, wage-earners, and earnings, 720, 728, 736.
Labrador, exports to, 139.
Lacquer. *See* Paints and varnishes.
Ladd, Story B., section on iron and steel industry, 3–71; tin and terne plate, 87–96; copper, lead, and zinc, smelting and refining, 101–125.

Lake and river traffic, importance to shipbuilding industry, 337, 338.
Lake Shore Electric System, power equipment, 171.
Lamp and other blacks, pigments, produced, 402, 508.
Lamp signal annunciators, electric, construction and advantages, 207, 208.
Lampblack, produced, 461; process of obtaining, 465.
Lamps and reflectors industry, establishments, wage-earners, and earnings, 720, 728, 736.
Lamps, decorative and miniature, X-ray bulbs, vacuum tubes, etc., produced, 183; discussion, 187–190. *See also* Arc lamps, Incandescent lamps, *and* Mercury vapor lamps.
Landaus, 312, 318, 324.
Lapidary work industry, establishments, wage-earners, and earnings, 649, 720, 728, 736.
Lard, refined, industry, establishments, wage-earners, and earnings, 720, 728, 736.
Lasts industry, establishments, wage-earners, and earnings, 720, 728, 736.
Lathes, metal working, produced, 227; improvement, 232, 233.
Laughing gas, produced, 479.
Lawn mowers, 137, 144, 150.
Lazaretto Guano Co., chamber process plant, 411.
Lead, bar, pipe, and sheet, industry, establishments, wage-earners, and earnings, 720, 728, 736.
Lead, smelting and refining, statistics, 101, 102, 113–122; establishments, wage-earners, and earnings, 113–116, 119, 121, 122; products, 113–122; used as material, 400, 507.
Lead oxides, produced, 402; used as material, 403, 463, 508; process of obtaining, 465.
Leather, used as material, in carriage and wagon industry, 304; tanned, curried, and finished, industry, establishments, wage-earners, and earnings, 651, 720, 728, 736; by states, territories, and geographic divisions, 760; by specified states, 774, 780, 784, 788, 790.
Leather goods industry, establishments, wage-earners, and earnings, 720, 728, 736.
Leather substitutes, produced, 475.
Le Blanc process of soda production, 420–422.
Leominster, Mass., rank in manufacture of piano materials, 250.
Lewis, George T., process of manufacturing sublimed white lead, 464.
Lighting carbons, 179.
Lighting plants, census, 158.
Lightning arresters, produced, types and construction, 212, 213.
Ligroïn, uses of, 580.
Lime, used as material, 400, 440, 442, 445, 480, 487, 507, 510, 512; produced, 479; chloride imported, 433.
Lime industry, establishments, wage-earners, and earnings, 720, 728, 736.
Lime spreaders, 136, 142, 148.
Limestone, used as material, 400, 440, 480, 507–509.
Lindenberg, Richard, steel plant, 23.
Linen goods industry, establishments, wage-earners, and earnings, 720, 728, 736.
Linseed oil, used as material, 400, 463, 508, 510.
Liquid dryers, japans, and lacquers, produced, 461, 508, 510.
Liquid fillers, produced, 461, 508, 510.
Liquors industry, distilled, establishments, wage-earners, and earnings, 720, 728, 736; by specified states, 778; malt, by specified states, 776, 782, 786, 790; vinous, rank of Pacific division in production, 705; by specified states, 774.
Listers, 136, 142, 148.
Litharge, 444, 465.
Lithographing and engraving industry, establishments, wage-earners, and earnings, 720, 728, 736.
Locomotives, electric, description of, in use on specified railroads, 171, 172; steam, built, by states, 362, 374, 378, 382; establishments, wage-earners, and earnings, 720, 728, 736.
Logwood, used as material, 451, 511; imports, 457; treatment, by compressed carbon dioxide, 481.
Logwood extract, used as material, 451; products, 511.
Logwood extracts, imports, 457.
Looking-glass and picture frames industry, establishments, wage-earners, and earnings, 720, 728, 736.
Louisiana Purchase Exposition, exhibit of process of liquefying hydrogen, 481.
Low-phosphorus pig iron, establishments reporting, and quantity produced, by states, 32, 74.
Lullius, Raymond, production of nitric acid, 412.
Lumber, used as material in carriage and wagon industry, 304; shipbuilding, 348, 350–353.
Lumber and planing mills, manufacturing agricultural implements, number and value, 138; establishments, wage-earners, and earnings, 651, 720, 728, 736; by states, territories, and geographic divisions, 762; by states, 774, 776, 778, 782, 786, 788, 790.
Lumber and timber products industry, power employed, 620–624; average size of steam engine employed, 628; establishments, wage-earners, and earnings, 651, 720, 728, 736; rank of Pacific division in production, 705; earnings by states, territories, and geographic divisions, 762; by specified states, 774–790.
Lunge, George, on galenite, 408; processes of sulphuric acid extraction, 409; uses of sulphuric acid, 411.

Mabery, on sulphur waste, 408; petroleum, 576.
McAdam, W. A., aluminum casting, patent for, 447.
Machinery. *See* Electrical machinery *and* Metal working machinery.
McKenna, Charles F., report on transportation of explosives, 473–475.
Madder, imported for consumption, 457.
Madison River Power Co., electrical transmission plant, 634.
Magnesia, calcined, produced, 479.
Magnesia sulphate. *See* Epsom salts.
Magnesite, used as material, 480, 487.
Magnetite arc lamp. *See* Arc lamps.
Magneto ignition, 215, 216; substations, 197.
Mail and mail carriers' wagons and carts, 312, 318, 324.
Mail cars, built, 366.
Maine, rank in shipbuilding industry, 341; water power used, 629.
Malt liquors industry. *See* Liquors industry.
Manganese dioxide, used as material, 442.
Manhattan Railway system, push-button control installed, 175.
Mannheim process, sulphuric acid extraction, 409, 410.
Mantels, slate, marble, and marbleized, industry, establishments, wage-earners, and earnings, 720, 728, 736.
Manure spreaders, 136, 142, 148.
Marble and stone work industry, establishments, wage-earners, and earnings, 720, 728, 736, 780.
Marcasite, formula, 407.
Marconi, autocoherer invented by, 203.
Mare Island navy yard, steel training bark built, 337.
Marine railways. *See* Railways, marine.
Markers and furrowers, 136, 144, 150.
Martin, Thomas Commerford, section on Electrical machinery, apparatus, and supplies, 157; power employed, 619.
Maryland, rank in iron and steel industry, 7, 8, 54.
Massachusetts, rank in specified industries, iron and steel, 7, 8; electrical machinery, 193, 206–208, 210, 214; metal working machinery, 227, 345; musical instruments, 242, 243; marine railways, 345; bleaching material, 442; power employed, 626, 629; boots and shoes, 655; cotton goods, 657; tobacco, cigars, and cigarettes, 666; women wage-earners, 680.
Masts and spars, 348, 350–353.
Match industry, establishments, wage-earners, and earnings, 720, 728, 738.
Materials used, cost, in specified industries, iron and steel, 4–6, 16, 18, 19; blast furnaces, 25, 27, 28, 41–43, 46, 47, 71, 72, 74; steel works and rolling mills, 49, 50, 52, 78–80, 52; forges and bloomeries, 70, 71; tin and terne plate, 87, 89–91, 94, 95, 97; copper, lead and zinc, smelting and refining, 101, 103, 105–108, 110–116, 119–124, 126; agricultural implements, 129, 131, 132, 142, 148; electrical machinery, 158, 159, 218; musical instruments, 239–241, 252, 256, 258, 260, 264, 266; automobiles, 269, 270, 273, 275, 282; bicycles and tricycles, 289, 291, 294; carriages and wagons, 301–303, 304, 307, 310, 316, 322; shipbuilding, 331–335,

348, 350, 352; steam and street railroad car, 357, 358, 364, 365, 367, 368–371, 374, 378, 382, 386, 388–390; chemicals and allied products, 398, 399, 400; acids, 404, 417, 504, 511; sodas, 421; alums, 4 28; coal tar products, 430; cyanides, 432; wood distillation, 435, 505, 512; fertilizers, 438, 440, 496, 509; bleaching materials, 441, 442; electrochemicals, 444, 445; dyestuffs, 450, 451, 502, 511; tanning materials, 458, 459; paints and varnishes, 461, 463, 494, 500, 508, 510; explosives, 468, 470, 498, 509; plastics, 475, 476; essential oils, 477, 478, 506, 512; gases, compressed and liquefied, 479, 480; chemicals, 482, 484, 486, 490, 507; bone, ivory, and lamp black, 507; coke, 515, 528; petroleum refining, 567, 569, 575.
Mathiesson Alkali Co., ammonia-soda process, 422.
Mathot, R. E., use of gas engines in metallurgical works, 637, 638.
Mats and matting industry, establishments, wage-earners, and earnings, 720, 728, 736.
Matte. *See* Copper, smelting and refining.
Matthews, on sulphur dyes, 455, 456.
Mattress and spring bed industry, establishments, wage-earners, and earnings, 720, 728, 736.
Mauve dyestuff, discovery of, 452.
Men. *See* Wage-earners and wages.
Men's clothing industry. *See* Clothing, men's.
Mercury bulb or vacuum tube, utilization of, 188, 189.
Mercury vapor lamps, development and improvement, 187, 188.
Meriden, Conn., rank in musical instrument industry, 248.
Meridian Fertilizer Co., chamber process plant, 411.
Merriam, Robert H., section on Bicycles and Tricycles, 289–297.
Merrimac Chemical Co., chamber process plant, 411.
Metal working machinery products, 225, 227; discussion, 225–236; exports and imports, 226; development, 231–236.
Metallic filaments, for incandescent lamps, 185–187.
Metallic sodium, used as material, 442.
Meters, prepayment. *See* Electric meters.
Mexican Government, use of rubber submarine cable, 206.
Mexican Light and Power Co., plant, 634.
Mexico, ores, imported from, 122; automobile exports to, 276.
Meyer's tangent system, sulphuric acid extraction, 409.
Michigan, rank in iron and steel industry, 7, 8; electric appliances, 193, 207, 210.
Michigan Alkali Co., ammonia-soda process, 422.
Middle states, iron and steel industry, 21, 22.
Milk, sugar of, imported, 488.
Mill cinder, scrap, etc., used as material, 13, 28, 43, 47, 72.
Miller, Fred J., section on Metal Working Machinery, 225–236.
Millinery and lace goods industry, establishments, wage-earners, and earnings, 720, 728, 736, 786.
Milling machines. *See* Metal working machinery.
Mineral and soda water industry, establishments, wage-earners, and earnings, 720, 728, 736.
Minor, John C., on carbon dioxide, 480, 481.
Mirror industry, establishments, wage-earners, and earnings, 720, 728, 736.
Missouri, rank in production of lead, 114, 116, 118.
Missouri River Power Co., electrical transmission plant, 634.
Mixer, or receiver, use, 35.
Model and pattern industry, other than paper, establishments, wage-earners, and earnings, 720, 728, 736.
Monazite, used as material, 484.
Monument and tombstone industry, establishments, wage-earners, and earnings, 720, 728, 736.
Moore system, vacuum vapor lamps, 188.
Moran Bros., battleship built by, 337.
Mordants. *See* Dyestuffs.
Morphia, imports, 485.
Motor, gasoline, use of, 278, 279.
Motor boat building, growth of industry, 340.
Motor car, in New York Central suburban traffic, 173.
Motor cycle, history, 291, 292.
Motor generators, dynamotors, and boosters, 163–173.
Motor rheostats apparatus, 209, 210.
Motors, electric, classification, production, and use, 157–173, 279, 619, 620, 628, 633, 634; compound, 169; steam, 277, 278; petrol, 278, 279; water, 619, 620, 631.
Mountain wagons, 312, 318, 324.
Mowers, 135, 136, 139, 144, 150.
Mucilage and paste industry, establishments, wage-earners, and earnings, 720, 728, 736.
Muck, or scrap bar, used as material, 13, 51–53, 55, 78.
Mundy, Arthur, telephonic submarine signalling, 199.
Munroe, Prof. Charles E., section on Chemicals and allied products, 397–512; report on transportation of explosives, 473–475; section on Coke, 515–541; Petroleum, 567–583.
Muriatic acid, production and use, 417, 418, 484, 487.
Musical instruments, attachments, and materials, section on, by William F. Wooster, 239–266; establishments, wage-earners, and earnings, 239–241, 252, 256–260, 720, 728, 736, 776, 786; products, 239–241, 243, 245, 247, 248, 250, 254, 257, 259, 262; exports and imports, 242.

Nail and tack plate, produced, 53, 55.
Nails, statistics of establishments, wage-earners, and earnings, production, kinds, and states reporting, 57–59, 718, 726, 736.
Naphtha and gasoline, produced, 570, 573, 575; kinds and uses, 580.
National Electric Light Association, report on electric heating, 210.
National Electrolytic Co., 445.
Natural gas, used as fuel, iron and steel industry, 12; steel works and rolling mills, 52, 80; blast furnaces, 74; tin and terne plate, 89, 91, 95.
Natural oils. *See* Oils, essential.
Naval stations, dry docks at, 345.
Navy yards, Government, shipbuilding operations, 335.
Needles, pins, and hooks and eyes industry, establishments, wage-earners, and earnings, 720, 728, 736.
Nernst lamps, description and advantages, 189, 190; for street lighting, 190.
Net and seine industry, establishments, wage-earners, and earnings, 720, 728, 736.
Nevada Mining and Milling Co., power, 631.
New England division, discussion relative to industries, wage-earners and earnings, 680–683. *See also* Geographic divisions.
New England states, iron and steel industry, 21.
Newfoundland, exports to, 139, 276; pyrites imported from, 407.
New Hampshire, women wage-earners, 680.
New Jersey, rank in production of iron and steel, 6, 7, 8; crucible steel, 69; incandescent lamps, 159; insulated wires and cables, 204; electric conduits, 206; electric measuring instruments, 214; marine railways, number and capacity, 345; bleaching materials, 442; tanning materials, 458.
New Jersey Zinc Co., contact process plant, 410.
New Mexico, women wage-earners, 680.
Newport News Shipbuilding Co., battle ships built, 337.
New York, rank in specified industries, iron and steel, 6, 8, 51, 54, 56, 68, 69; agricultural implements, 133; telephone manufacture, 193; insulated wire and cable industry, 204; electric conduits, 206; electric annunciators, 207; electric clocks, 208; electric heating, cooking, and welding appliances, 210; musical instruments, 242, 243; marine railways, number and capacity, 345; bleaching materials, 442; electro-chemicals, 444; horsepower, 626; waterpower, 629.
New York, New Haven and Hartford Railroad, single phase motor equipment, 171, 172.
New York, N. Y., rank in production of piano and organ materials, 250, 251; automobile manufacture, 274.
New York Central and Hudson River Railroad, electric storage battery equipment, 172, 173; copper wire and cable, length and weight of, used in transmission circuits, 204.
Niagara Falls, N. Y., rank in electro-chemical industry, 445.
Niagara Falls Hydraulic Power and Manufacturing Co., 445.

Niagara Falls Power Co., development of power and description of apparatus, 164, 445.
Niagara, Lockport and Ontario Co., electrical transmission plant, 634.
Niagara Research Laboratory, 445.
Niter, for dynamites, 472.
Niter cake, composition and uses, 415; produced, 486, 511; imports, 489.
Nitrate of ammonia, used as material, 403, 470, 509.
Nitrate of potash. *See* Potash, nitrate.
Nitrate of soda, used as material, 400, 404, 406, 440, 487, 488, 509, 511.
Nitric acid, used as material, 400, 403, 412–415, 470, 476, 484, 487, 507–509; produced, 401, 404, 412–415, 511; establishments, by states, 412; results obtained with Valentiner vacuum apparatus, 414.
Nitrogen, in slaughterhouse fertilizers, 440, 441.
Nitroglycerin, produced, 402, 468, 471; used as material, 403, 509; percentage of nitric and sulphuric acid in, 416; artificial refrigeration, 471, 472.
Noble Electric Steel Co., reduction works, 23.
Nonargentiferous ores, produced, 115, 117, 119; establishments, 117; by states, 118; gross and net values, 120; summary, 121.
Noosack Falls Power Co., plant, 634.
Northern Aluminum Co., plant, 446.
Northern California Power Co., plant, 634.
Northern Ohio Traction and Light Co., storage battery equipment, 177.
Northern South Atlantic division, discussion relative to industries, wage-earners, and earnings, 685–688. *See also* Geographic divisions.
Norton Emery Wheel Co., alundum manufacture, 445, 447.
Nottoden, Norway, electric furnaces for nitric acid distillation, 414.
Nux vomica, imports, 485.

Oak and chestnut extracts, produced, 458, 511.
Oakum and pitch, used as material in shipbuilding, 348, 350–353.
Oakum industry, establishments, wage-earners, and earnings, 649, 720, 728, 736.
Oceania, exports to, automobiles and automobile parts, 276; carriages and wagons, 307; steam and street railroad products, 367.
Ohio, rank in, value of iron and steel products, 6, 7; production of iron for steel making, 34, 35; steel works and rolling mills products, 51, 54–56; use of natural gas as fuel, 52; total steel production, 62; open-hearth steel, 67, 68; steel castings, 68; agricultural implements, 133; metal working machinery, 225–228, 230; steam and street railroad cars, etc., 364; horsepower employed, 626; storage batteries installed by interurban railway systems, 177; telephonic manufacturing industry, 193.
Ohio Farmers Fertilizer Co., chamber process plant, 411.
Oil, used as fuel in specified industries, iron and steel, 12, 52, 80; tin and terne plate dipping and black plate combined, 89; tin and terne dipping, 91; black plate, 95; used as material, tin and terne plate, 97; compressed and liquefied gases, 480.
Oil, cottonseed and cake, industry, establishments, wage-earners, and earnings, 649, 690, 720, 728, 736; by specified states, 774, 776, 778, 788.
Oil, essential, linseed, etc., statistics of production, establishments, wage-earners, and earnings, 402, 477, 512, 720, 728, 736.
Oil cake, uses, 448.
Oilcloth and linoleum industries, establishments, wage-earners, and earnings, 720, 728, 736.
Oil of aniline, imports, 457.
Oils, used as material in dyestuffs industry, 451; paint, 476, 508; volatile, or essential, and distilled, imports and exports, 478; varnish, 510; petroleum, produced, 570, 575; exports, 573; classifications, 580–582; methods of transportation, 582, 583; burning, definition of term, 572; mineral, imports, 574.
Olds, R. E., experiments with steam motors, 277, 278.
Oleomargarine industry, establishments, wage-earners, and earnings, 720, 728, 736.
Oleum, produced, 405, 511.
Oller, George E., section on Automobiles, 269–280.
Omnibuses, 312, 318, 324.
Ontario Power Co., plant, 631, 634.
Open-hearth steel, furnaces and establishments, 14, 15, 61, 66; products, 53, 66; by states, 67; number and capacity of furnaces, 68, 69; summary, 80–83.
Optical goods industry, establishments, wage-earners, and earnings, 720, 728, 736.
Orchil, imported, 457.
Ordnance, produced, 60.
Ordnance and ordnance stores industry, establishments, wage-earners, and earnings, 720, 728, 736.
Ore wagons, 312, 318, 324.
Ores, used as material, lead smelting industry, 115, 116, 119, 121; imported, 122; zinc smelting, 123, 124, 126. *See also* Iron ore.
Ores, chrome and iron, used in manufacture electro-chemicals, 445.
Ores and concentrates, used as material, in copper smelting and refining industry, 105–108, 110, 112.
Organ materials and parts, 250, 251; summary, 258, 259.
Organs, summaries, 240, 256, 257; produced, 240, 245, 247; reed, 245, 246; pipe, 246, 247; street and self-playing, 248, 249.
Osium, chemical properties, advantages, 186.
Otto, Dr. N. A., use of four-cycle engine, 278.
Otto cycle, used for automobiles, 278.
Otto-Hoffman, by-product oven. *See* Ovens.
Ovens, coke, number and value, 516; by-product, description and methods of operating, 521, 534–539; active establishments, 521, 522; idle, 522; Belgian, 533; beehive, 534; Knab-Carvés, 534; Weeks, 534; Coppée, 534, 537; Otto-Hoffman, 534, 537, 538; Semet-Solvay, 536, 537; United-Otto, 538; Rothberg, 538, 539.
Oxalic acid, imported, 419.
Oxide of zinc, produced, 461, 463; method of production, 465.
Oxides of lead, produced, 461, 508, 510.
Oxone, production and uses, 443.
Oxygen, produced, 479.

Pacific coast district, shipbuilding, 338, 339.
Pacific division, discussion relative to industries, wage-earners, and earnings, 705–707. *See also* Geographic divisions.
Paints and varnishes, establishments, wage-earners, and earnings, 398, 399, 460–463, 492, 494, 720, 728, 736; produced, 398, 399, 402, 461, 508–510; used as material, 304, 310, 316, 322, 508–510. *See also* Varnishes.
Palm oil, used as material, 89, 91, 97.
Palmetto, extract and root, 511.
Panhard and Levassor, motor car constructed, 277.
Paper, use in cable insulation, 205.
Paper and wood pulp industry, power, 620, 624, 628; establishments, wage-earners, and earnings, 651, 720, 728, 738, 764, 780, 782, 786, 790.
Paper goods industry, not elsewhere specified, establishments, wage-earners, and earnings, 720, 728, 738.
Paper pattern industry, establishments, wage-earners, and earnings, 720, 728, 738.
Paraffin, oil and wax, 570–583.
Park wagons, 312, 318, 324.
Parsons, steam turbine invented, 628.
Paste and putty fillers, produced, 508–510. *See also* Paints and varnishes.
Patent medicines and compounds industry, establishments, wage-earners, and earnings, 720, 728, 738.
Patterson, G. W., on rebuilding mixed acids, 416.
Paving material industry, establishments, wage-earners, and earnings, 720, 728, 738.
Pea hullers, 137, 144, 150.
Peabody, George, first incandescent light fixture made for, 191.
Peanut industry, establishments, wage-earners, and earnings, 649, 720, 728, 738.
Pearce, William, first incandescent light fixture made by, 191.
Pencils, lead, industry, establishments, wage-earners, and earnings, 720, 728, 738.
Penniman, Russell S., protected ammonium nitrate invented by, 473.
Pennington, E. J., motor cycle experiments, 292.
Pennock, on sulphuric acid waste, 408.
Pennsylvania, rank in iron and steel products, 30, 34–36, 50, 52, 54–56, 59, 60, 62, 66–69; black plates, 96; electrical machinery, 206, 207, 214; metal working machinery, 230; steam and street railroad car industry, 364; coke industry, 520; petroleum refining industry, 568; power used, 626, 636.

Pennsylvania Railroad terminal, New York city, Nernst lamp used, 190.
Pennsylvania Salt Co., soda production, 422.
Pens, fountain and stylographic, industry, establishments, wage-earners, and earnings, 720, 728, 738; gold, establishments, wage-earners, and earnings, 649, 720, 728, 738.
Pentane, 580.
Peppermint oil, produced, 477, 512. *See also* Oils, essential.
Pepsin, 482.
Perkin, William Henry, discovery of mauve, 452.
Perfumery and cosmetic industry, establishments, wage-earners, and earnings, 720, 728, 738.
Peroxides, produced, 443.
Petrolatum, produced, 581.
Petroleum refining industry, establishments, wage-earners, and earnings, 567, 568, 574, 720, 728, 738, 784; products, 567, 570, 571–575; history, 576–583; patents, 587–615.
Peyton Chemical Co., contact process plant, 410.
Phaetons, 272, 273, 312, 314, 318, 320, 324.
Philippine Islands, submarine cable system created by Signal Corps in, 206.
Phoenix mills, compound motors installed, 169.
Phonograph and graphophone industry, products, 264, 266; establishments, wage-earners, and earnings, 264, 720, 728, 738.
Phosphate, imported, 441.
Phosphate of soda, produced, 486, 508.
Phosphate rock, 400, 440, 445, 487, 507.
Phosphoric acid, used in manufacturing bleaching materials, 442.
Phosphorus, manufacture, 450; imported, 485.
Photographic apparatus and materials industry, establishments, wage-earners, and earnings, 720, 728, 738.
Photolithographing and photoengraving industry, establishments, wage-earners, and earnings, 649, 720, 728, 738.
Piano d'Orta, Italy, production of lime nitrogen, 434.
Piano materials and parts, 250, 251; detailed summary, 258, 259.
Pianos, summaries, 242, 243; produced, 243; classes discussed, 243, 244; number and value, 243, 252–255.
Pickles, preserves, and sauces, industry, establishments, wage-earners, and earnings, 649, 720, 728, 738.
Pig lead, 89, 91, 97, 463, 487, 508.
Pig iron, used as material, 13, 35, 51, 52, 71, 74, 78, 89, 95, 348, 350–353; establishments, wage-earners, and earnings, 25, 26, 28, 30, 32, 35, 36, 41–47, 72–76; production, 25–48, 74; exported, 40; chill cast, 74.
Pigments, produced, 402, 466, 508, 510.
Pig tin used as material, 89, 91, 97.
Pikes Peak Hydro-Electric Co., machinery used, 631.
Pintsch gas, 481.
Pipe, iron and steel, industry, establishments, wage-earners, and earnings, 720, 728, 736.
Pipe and reed organs. *See* Organs.
Pipe, or tubes, clinched, brazed, and wrought, 60.
Pipes, tobacco, industry, establishments, wage-earners, and earnings, 720, 728, 738.
Pitch, method of obtaining, 582. *See also* Petroleum.
Pittsburg, Pa., first blast furnace gas engine installed, 637.
Pittsburg Electric Works, compound motor installed, 169.
Pittsburg Reduction Co., bauxite mines, plant, 445, 446.
Planers, 227, 228.
Planters, bean, corn, cotton, and potato, 135, 136, 142, 148.
Plastics, produced, 402, 475, 507; exports and imports, 477.
Plate towers, for acid condensation, 413, 418.
Plated ware industry, establishments, wage-earners, and earnings, 720, 728, 738, 774.
Plates, beams, etc., used as material, 348, 350–353.
Platinum, used as material, 484.
Platinum salts, produced, 402, 482, 508.
Plows, 135, 136, 139, 144, 150.
Plumbago. *See* Electro-chemicals *and* Graphite.
Plumbers' supplies industry, establishments, wage-earners, and earnings, 720, 728, 738.
Pocketbook industry, establishments, wage-earners, and earnings, 720, 728, 738.
Police, fire, district, and miscellaneous telegraph apparatus, 200, 204.
Police patrol wagons, 312, 318, 324.
Poplar, use in automobile manufacture, 280.
Porcelain electrical supplies, 157, 158.
Portable tools, development and uses, 233.
Portland, Oreg., magnetite arc lamps installed, 182, 183.
Portugal, pyrites from, 407.
Potash nitrate, used as material, 400, 440, 470, 507, 509; imported, 488.
Potashes, discussion of production and methods of manufacture, 425–428; imports, 428, 434, 488; used as materials, 400, 442, 507.
Potassium, produced, 401, 426, 433, 434, 507; used as material, 445.
Potassium chloride, extraction, patents granted A. Frank, 426.
Potato coverers, diggers, hillers, and hooks, 136, 144, 150.
Pottery, terra cotta, and fire clay industry, products, 157; establishments, wage-earners, and earnings, 651, 720, 728, 738, 764, 784–788.
Poultry netting, 59.
Power employed in specified industries, iron and steel, 76, 80, 82; tin and terne plate, 97; copper, smelting and refining, 103, 113; lead, smelting and refining, 113, 122; zinc smelting, 122, 126; agricultural implements, 139, 146, 152; electrical machinery, apparatus, and supplies, 161, 166, 167, 173, 220; musical instruments, 254, 257, 259, 262, 266; automobiles, 273, 274, 284; bicycles and tricycles, 296; carriages and wagons, 314, 320, 326; shipbuilding, 347, 348, 352; steam and street railroad cars, 372, 376, 380, 384, 392; chemicals and allied products, 492, 494, 496, 499, 500, 502, 504, 505, 506; coke, 530; petroleum refining, 575; in manufactures, 619–625, 627, 630, 632, 634, 636, 638.
Pratt, Joseph Hyde, on production of sublimed and zinc lead, 464.
Presses, 570, 575.
Printing and publishing industry, book and job, wage-earners, and earnings, 651, 720, 728, 738; 766, 774, 776, 780, 782, 786; music, establishments, wage-earners, and earnings, 720, 728, 738; newspapers and periodicals, 651, 720, 728, 738, 768, 774–780, 786, 788.
Printing materials industry, establishments, wage-earners, and earnings, 720, 728, 738.
Printing telegraph systems. *See* Telegraph systems.
Prison vans, 312, 318, 324.
Products, value of, in specified industries, iron and steel, 4–6, 16, 18, 19; blast furnaces, 25, 27, 29, 41, 42, 44, 46, 48, 74; steel works and rolling mills, 49–50, 52–53, 80; forges and bloomeries, 70, 71; tin and terne plate, 87, 90–92, 94, 95, 97; copper, lead, and zinc, smelting and refining, 101, 103, 105, 107, 110–117, 119–126; agricultural implements, 129, 131, 132, 135, 138, 142, 148; electrical machinery, 158, 159, 161, 166, 167, 173, 174, 176, 179, 180, 183, 190, 192, 200, 204, 207, 208, 210, 212, 215, 217, 218; metal working machinery, 225, 227; musical instruments, 239–241, 254, 257, 259, 262, 264, 266; automobiles, 269, 270, 272, 273, 275, 282, 284; bicycles and tricycles, 289, 291, 294; carriages and wagons, 301–305, 307, 312, 318, 324; shipbuilding, 331–335, 348, 350, 352; steam and street railroad cars, 357, 358, 362–365, 367–371, 374, 378, 382, 386, 388–390; chemicals and allied products, 398, 399, 401, 402; acids, 404, 412, 415, 417–419, 504, 511; sodas, 421, 422; potashes, 426; alums, 428, 429; coal tar products, 430, 431; cyanides, 432, 433; wood distillation, 435, 436, 505, 512; fertilizers, 438, 439, 496, 509; bleaching materials, 441, 442; chemicals produced by electricity, 444, 445; dyestuffs and extracts, 450, 451, 502, 511; tanning materials, 458, 459; paints and varnishes, 461, 463, 494, 500, 508, 510; explosives, 468, 470, 499, 509; plastics, 475, 476; essential oils, 477, 478, 506, 512; gases, compressed and liquefied, 479, 480; fine chemicals, 482, 484; general chemicals, 486, 487; chemicals, 480, 507; bone, ivory, and lampblack, 507; coke, 515, 528, 530; petroleum refining, 567, 570, 575.
Projectors. *See* Searchlights and projectors.
Proprietors and firm members, of establishments engaged in specified industries, iron and steel, 72, 76; tin and terne plate,

96; copper, lead, and zinc, smelting and refining, 112, 121, 125; agricultural implements, 142, 148; electrical machinery, 218; musical instruments, 252, 256, 258, 260, 266; automobiles, 282; bicycles and tricycles, 294; carriages and wagons, 310, 316, 322; shipbuilding, 348, 350, 352; steam and street railroad cars, 371, 389; chemicals and allied products, 490, 492, 494, 500, 502, 504–507; coke, 528; petroleum refining, 574.
Puget Sound Power Co., plant 634.
Pulp goods industry, establishments, wage-earners, and earnings, 720, 728, 738.
Pumps, 137, 144, 150.
Pupin, Dr. M. I., locating induction coils, 205.
Push-button control system, for switchboards, 175.
Putty, produced, 461, 467.
Pyrite cinder, produced, 407, 511.
Pyrites, statistics, 404–409; formula, 407; produced and imported, 407; used as material, 400, 404, 406, 407, 409, 440, 507, 509, 575.
Pyrocellulose, composition, 416.
Pyroligneous acid, produced, 436; imported, 437.
Pyroxylin, for smokeless powder, 403, 416, 510; plastics, 416, 475, 507; varnish, 402, 461, 508, 510.
Pyrrhotite, formula, 407; development, 408.

Quincy process, for purification of service waters, 488.
Quinia sulphate, imported, 485.

Rabe contact process, 409.
Rails, iron and steel, used as material, 13, 52, 78; produced, 52, 53, 54.
Railways, marine, 345, 346. *See also* Electric railways *and* Shipbuilding.
Rauh, E., Sons Fertilizer Co., chamber process plant, 411.
Reading, Pa., statistics of automobile manufacture, 274.
Reapers, 136, 137, 144, 150.
Red prussiate of potash, imported, 434.
Reese, Dr. Charles L., manufacture of nitroglycerin, 471, 472.
Refineries, petroleum, 567.
Refrigerator industry, establishments, wage-earners, and earnings, 720, 728, 738.
Regalia and society banners and emblems industry, establishments, wage-earners, and earnings, 720, 728, 738.
Repairs and repair shops, statistics, shipbuilding, 343, 344, 348, 350; steam railroad, 362, 368, 370, 374, 378, 382; street railroad, 386, 388, 390.
Repauno Chemical Co., contact process plant, 410.
Residuum, produced, 570–573, 575, 581, 582.
Resistances, dimmer, construction, and use in theaters, 209. *See also* Rheostats and resistances.
Rheostats and resistances, statistics, 208–210.
Rhode Island, rank in production of electrical machinery and appliances, 204; women wage-earners, 680.
Rice cleaning and polishing industry, establishments, wage-earners, and earnings, 649, 720, 728, 738.
Richmond Guano Co., chamber process plant, 411.
Rio Tinto mine, Spain, pyrites from, 407.
Road carts and wagons, 137, 144, 150, 312, 318, 324.
Roberts Chemical Co., manufacture of caustic potash, 427.
Rockaways, 312, 313, 324.
Rocky Mountain division, discussion relative to industries, wage-earners, and earnings, 701–703. *See also* Geographic divisions.
Roechling iron and steel works, electric induction furnace used, 24.
Rohrman and Lunge, plate towers for acid condensation, 413, 418.
Rollers, 136, 137, 144, 150.
Rolling mills, establishments and products, 3, 59, 60, 80, 82.
Roofing materials industry, establishments, wage-earners, and earnings, 649, 722, 730, 738.
Rowland, Prof. H. A., printing telegraph system, 200, 201.
Royster, F. S., Guano Co., chamber process plant, 411.
Rubber, use in insulating material, 205, 206.
Rubber and elastic goods industry, 275, 722, 730, 774, 780.
Rubber boot and shoe industry, establishments, wage-earners, and earnings, 716, 724, 732.
Rubber substitutes, produced, 475.
Rubber tires. *See* Tires, rubber.
Rules, ivory and wood, establishments, wage-earners, and earnings, 649, 722, 730, 738.
Runabouts, 272, 273, 312, 314, 318, 320, 324, 326.
Russia, agricultural implement exports to, 139.

Saddlery and harness industry, establishments, wage-earners, and earnings, 722, 730, 738.
Safe and vault industry, establishments, wage-earners, and earnings, 722, 730, 738.
Safety explosives, development of industry, 473.
Safflower and extract of saffron and saffron cake, imported, 457.
Sail vessels, discussion, 341. *See also* Shipbuilding.
Sal soda, produced, 401, 421, 507; imported, 425.
Salaried officials, clerks, etc., number and salaries in establishments engaged in specified industries, iron and steel, 4–6, 16, 18, 19; blast furnaces, 25, 27, 41, 42, 46, 72; steel works and rolling mills, 49, 50, 76; forges and bloomeries, 70; tin and terne plate, 87, 89–91, 94–96; copper, lead, and zinc, smelting and refining, 101, 103, 105, 107, 110, 112–115, 119, 121–125; agricultural implements, 129, 131, 132, 142, 148; electrical machinery, 158, 159, 218; musical instruments, 239–241, 252, 256, 258, 260, 264, 266; automobiles, 269, 270, 275, 282; bicycles and tricycles, 289, 291, 294; carriages and wagons, 301–303, 310, 316, 322; shipbuilding, 331, 332, 334, 335, 348, 350, 352; steam and street railroad cars, 357, 358, 364, 365, 367, 368–370, 371, 374, 378, 382, 386, 389, 390; chemicals and allied products, 398, 399; acids, 404, 417, 504; sodas, 421; alums, 428; coal tar products, 430; cyanides, 432; wood distillation 435, 505; fertilizers, 438, 494; bleaching materials, 441; electrochemicals, 444; dyestuffs, 450, 502; tanning materials, 458; paints and varnishes, 461, 463, 492, 500; explosives, 468, 470, 498; plastics, 475, 476; essential oils, 477, 506; gases, compressed and liquefied, 479; chemicals, 482, 486, 490; bone, ivory, and lamp black, 507; coke, 515, 528; petroleum refining, 567, 574.
Salicylic acid, imported, 419.
Salt, use in soda industry, 420–423; used as material, 400, 440, 442, 451, 487, 507; process of decomposing, 442.
Salt cake, produced, 486; imported, 489.
Salt industry, establishments, wage-earners, and earnings, 722, 730, 738.
Saltpeter, produced, 486; crude, imports, 488; used as material, 509.
San Domingo, Portugal, source of pyrites supply, 407.
Saratoga Springs, N. Y., carbon dioxide production, 480, 481.
Sassafras oil, produced, 477, 512. *See also* Oils, essential.
Sausage industry, establishments, wage-earners, and earnings, 722, 730, 738.
Saw industry, establishments, wage-earners, and earnings, 722, 730, 738.
Sawing machines, produced, 227, 231.
Sawmills, portable, 137, 144, 150.
Sayles Bleacheries, chamber process plant, 411.
Scales and balances industry, establishments, wage-earners, and earnings, 649, 722, 730, 738.
Schatterbeck, on arsenic sulphide waste, 409.
Schoellkopf, J. F., on development of the coal tar industry, 453–455.
Schroeder process, sulphuric acid extraction, 409, 410.
Scott Bros. Fertilizer Co., chamber process plant, 411.
Scrap bar. *See* Muck and scrap bar.
Scrap iron and steel, used as material, 13, 44, 52, 71, 78, 89, 95.
Screw machines, importance of magazine attachment, 234.
Screws, machine and wood, industry, establishments, wage-earners, and earnings, 722, 730, 738.
Scythe snaths, 136, 144, 150.
Scythes, 135, 136, 144, 150.
Searchlights and projectors, produced, 183.
Seattle-Tacoma Power Co., plant, 631, 634.
Seed separators, 135–138, 144, 150.

Seed sowers, 136, 142, 148.
Seeders and planters, 135–138, 142, 148.
Semet-Solvay, by-product oven. *See* Ovens.
Serpollet, Leon, application of steam to road vehicles, 277, 278.
Sewing machine cases industry, establishments, wage-earners, and earnings, 722, 730, 738.
Sewing machines and attachments industry, establishments, wage-earners, and earnings, 722, 730, 738.
Shawinigan Water and Power Co., plant, 634.
Sheet zinc, produced, 125, 126.
Shepard, T. P., & Co., chamber process plant, 411.
Shipbuilding industry, discussion relating to branches, production, and development, 331-353; by branches, 332, 333; materials used, 333; products, 333, 334; by watershed districts, 334; Governmental establishments, 335; private vessels launched, small boats, and repair work, 335–339; steam and other power vessels, 340, 341; sail vessels, 341; canal boats, 341, 342; small boats, 342; repair work, 343; equipment of shipyards, 343; dry docks, 344; marine railways, 345, 346; power, 347; detailed summary, 347–353; establishments, wage-earners, and earnings, 722, 730, 738; by specified states, 780.
Ships, changes in construction, 331.
Shipyards, Government, 335; vessels launched during 1904, 337; value of repair work, 343; dry docks, 345.
Shipyards, private, vessels launched during 1904, 336–341; value of repair work, 343, 344; dry docks, 344, 345.
Shirt industry, establishments, wage-earners, and earnings, 651, 722, 730, 738; by states, territories, and geographic divisions, 770; by specified states, 780, 786.
Shoddy industry, establishments, wage-earners, and earnings, 649, 722, 730, 738.
Shoe tacks and shoe nails. *See* Nails.
Shoes, horse and mule, produced, 60.
Shovels, spades, and scoops, agricultural, 137, 144, 150.
Show case industry, establishments, wage-earners, and earnings, 722, 730, 738.
Sickles, 144, 150.
Siemens Bros., resistance rods, patent, 448.
Siemens-Halske Co., Germany, tantalum lamps, 185.
Signal Corps, United States, adoption of telautograph, 202; submarine cables created, 206.
Signals, telephone, electromagnetic, 193, 194; incandescent lamp, 194; submarine, 199.
Silicon, metallic, production, 23.
Silk, artificial, industry, development, 476, 477.
Silk and silk goods industry, power, 621–624; establishments, wage-earners, and earnings, 651, 722, 730, 738; by states, territories, and geographic divisions, 770; by specified states. 774, 784, 786, 788.
Silver, product, copper and lead smelting and refining industry, 102; copper smelting and refining, 105, 107–110, 112, 113; lead smelting and refining, 115, 117–122; establishments reporting gross and net values, 120; imports and exports, 122; use as material in fine chemicals, 484.
Silver salts, produced, 402, 482, 508.
Silversmithing and silverware industry, establishments, wage-earners, and earnings, 722, 730, 738; by specified states, 788.
Single phase alternating current dynamos, uses, 162.
Single phase motor equipment, description, 171.
Single phase induction motors. *See* Electric motors.
Singletrees, agricultural, 137, 144, 150.
Sirup evaporators, 137, 144, 150.
Siskiyou Electric Power Co., plant, 634.
Sizes, dyestuffs, produced, 451, 511.
Skelp, iron and steel, used as material, 13, 78; produced, 52, 53, 55.
Slack. *See* Bituminous coal and slack.
Slag pits, number and capacity, 40.
Slaughterhouse fertilizing materials, grades, 441.
Slaughtering and meat packing industry, establishments, wage-earners, and earnings, 722, 730, 738; by specified states, 776.
Sleds. *See* Sleighs and sleds.
Sleeping cars, built, 366.
Sleighs and sleds, 304–306, 312, 314, 318, 320, 324, 326.
Slotters and shapers, 227, 230.
Sludge acid. *See* Acid, sludge.
Smelter smoke, industrial value, 408.
Smelting and refining industry, establishments, wage-earners, and earnings, 722, 730, 738. *See also* Copper, lead, and zinc, smelting and refining.
Smelting furnaces, electric, number in United States and Canada, 450.
Smokeless powder, produced, 402, 468, 509; classes and process of manufacture, 472, 473.
Soap industry, quantity of sodas used, 424; potash or pearlash, 427; establishments, wage-earners, and earnings, 722, 730, 738.
Soda alum, produced, 429.
Soda ash, produced, 401, 421, 507; imported, 425; used as material, 442, 451, 487.
Soda water apparatus industry, establishments, wage-earners, and earnings, 722, 730, 738.
Sodas, produced, 401, 421, 507, 509; discussion relating to classes, production, and uses, 420–425; summary, 421; establishments, by states, 422; the world's production, 423; imports, 425, 485, 489; used as material, 509, 512.
Sodium, value as copper substitute in electric conductors, 449, 450; used as material, 507.
Sodium cyanide, produced, 436.
Sodium dioxide, Harold J. Turner on utilization, 443.
Sodium phosphates, produced, 402.
Solvay, Ernest, process of soda production, 421, 422.
Solvay Process Co., ammonia-soda process in use, 422.
Sorghum evaporators, 137, 144, 150.
Sounding boards and bridges, piano, used as material, 250.
South America, exports to, automobiles and automobile parts, 276; carriages and wagons, 307; steam railroad cars and parts, 367.
Southern North Atlantic division, discussion relative to industries, wage-earners, and earnings, 683–685. *See also* Geographic divisions.
Southern South Atlantic division, discussion relative to industries, wage-earners, and earnings, 688–690. *See also* Geographic divisions.
Southern states, iron and steel industry in, 22; development of power, 626.
Southern States Fertilizer Co., chamber process plant, 411.
Southwest Chemical Co., chamber process plant, 411.
Spain, pyrites imported into United States from, 407.
Speed adjustment devices for metal working machinery, 232, 233.
Spelter, produced, 122, 124–126.
Sphalerite, formula, 407; value as a sulphuric acid producer, 408.
Spiders, four-wheeled, 312, 318, 324.
Spiegeleisen, produced, 30, 33, 35, 74. *See also* Pig iron.
Spikes. *See* Nails.
Splice bars, produced, 53, 54.
Sporting goods industry, establishments, wage-earners, and earnings, 722, 730, 738.
Spring River Power Co., plant, 634.
Springs, iron and steel, produced, and states reporting, 60.
Springs, steel, car, and carriage industry, establishments, wage-earners, and earnings, 722, 730, 738.
Sprinklers, street, 312, 318, 324.
Stackers, agricultural, 136, 144, 150.
Stacks, increase in number and capacity, 37, 39, 40.
Stalk cutters, 136, 144, 150.
Stamford, Conn., rank in manufacture of piano materials, 250, 251.
Stamped ware industry, establishments, wage-earners, and earnings, 722, 730, 738.
Stamping, flanging, and forming machines, produced, 227, 228.
Standard Chemical and Oil Co., chamber process plant, 411.
Stanhopes, automobiles, 272, 273; carriages, 312, 318, 324.
Starch, used as a material, 451.
Starch industry, establishments, wage-earners, and earnings, 722, 730, 738.
Stassano electric furnace, 22, 23.
Stassfurt, Germany, potash salt works, 426.
Statuary and art goods industry, establishments, wage-earners, and earnings, 649, 722, 730, 738.

Steam and street railroad cars. *See* Cars.
Steam engines, portable, 137, 144, 150.
Steam fitting and heating apparatus industry, establishments, wage-earners, and earnings, 722, 730, 738.
Steam packing industry, establishments, wage-earners, and earnings, 722, 730, 738.
Steam turbines, description and uses, 163, 164.
Steampower, statistics of, 627. *See also* Power.
Steel, Bessemer. *See* Bessemer steel.
Steel, open-hearth. *See* Open-hearth steel.
Steel production, statistics, 61–70, 76–83. *See also* Iron and steel industry.
Steel vessels. *See* Vessels, iron and steel, and wooden.
Steel works and rolling mills, establishments, 8, 14, 49, 51; wage-earners, 11, 49; fuel consumed, 12; iron ore consumed, 13; products, 14, 49, 52–60; discussion of statistics, 48–70; summaries, 49, 53, 76–83; materials used, 51, 52; equipment, 60, 61; steel production, 61–70.
Steel works and rolling mills and forges and bloomeries, summary, 19; by geographic divisions, 20.
Stencil and brand industry, establishments, wage-earners, and earnings, 722, 730, 738.
Stereotyping and electrotyping industry, establishments, wage-earners, and earnings, 722, 730, 738.
Sterling White Lead Co., manufacturing process, 463.
Stills, 568, 575, 578.
Stock cars, built, 366.
Stolberg, Germany, sulphuric acid furnace, 408.
Storage batteries. *See* Batteries, storage and primary.
Stove and furnace industry, establishments, wage-earners, and earnings, 722, 730, 738, 782, 786.
Stove industry, gas and oil, establishments, wage-earners, and earnings, 722, 730, 738.
Stoves, electric. *See* Electric heating apparatus.
"Straightaway" switchboard, 175.
Straw goods, not elsewhere specified, establishments, wage-earners, and earnings, 722, 730, 738.
Straw stackers, 137, 144, 150.
Structural ironwork industry, establishments, wage-earners, and earnings, 722, 730, 738, 786, 788.
Strychnia, imported, 485.
Submarine cables, insulation, 205; Philippine Islands and Alaska, 206.
Sugar and molasses refining industry, establishments, wage-earners, and earnings, 722, 730, 738, 778.
Sulkies, 312, 318, 324.
Sulphur, production, 400–409; imports, 407, 489; used as material, 440–442, 451, 470, 487, 507, 511, 575.
Sulphuric, nitric, and mixed acids industry, discussion, 403–417; detailed summary, 511; establishments, wage-earners, and earnings, 722, 730, 738.
Sulphuric acid, used as materials, 89, 91, 97, 400, 403, 411, 440, 451, 470, 480, 484, 487, 507, 508, 509, 511, 575; production, 125, 401, 403–410; establishments, wage-earners, and earnings, 404, 405; imports, 407, 419; plants, 410, 411.
Sumac, imported, 460; leaves, used as material, 511; extract produced, 511.
Superphosphates. *See* Fertilizers.
Surgical appliances industry, establishments, wage-earners, and earnings, 722, 730, 738.
Surreys, 272, 273, 312, 314, 318, 320, 324, 326.
Swank, J. M., on fuel for iron smelting, 540.
Swedish billets. *See* Iron and steel industry, materials used.
Sweepers, street, 312, 318, 324.
Switchboards, for light and power, 174–176. *See also* Telephone switchboards.
Synchronous alternating current motors. *See* Motors, electric.

Tack plates, states reporting, 55.
Tacks and small nails. *See* Nails.
Taggers tin, production, imports, exports, and consumption, 92.
Tallow and fats, used as material, 400, 507.
Tallyhos, 312, 318, 324.
Tandems, 312, 318, 324.
Tanks, storage, used in petroleum refining industry, 570, 575.
Tannage, chrome, Frank Hall Thorp on process, 459.
Tannic acid, imports consumed, 419; produced, 511.
Tanning materials, natural and artificial extracts produced, 402, 458; discussion, 457–460; establishments manufacturing, 458; imports and exports, 460.
Tantalum, use and chemical properties, 185.
Tapley, W. H., on advantages of electric motors in printing press work, 170.
Tar, produced, 436, 523; description and uses, 540, 541; oil, 436. *See also* Coal tar.
Tartar, cream, produced, 402, 486, 508; imports, 488.
Tartaric acid, produced, 401, 507; imports consumed, 419.
Telautograph, description and uses, 202.
Telegraph apparatus, discussion relative to, 200–204.
Telegraph switchboards, parts and supplies, 200.
Telegraph systems, printing, description of, 200–202; Rowland, 200; Murray, Buckingham, and Barclay, 201; Delany, 201, 202; writing, development of, 202; wireless, value of apparatus, 200; uses and descriptions, 202–204.
Telegraphone, Poulsen, description and uses, 198–200.
Telephone and telegraph system, census of, 157.
Telephone apparatus, development of industry, 159, 160; statistics of production and use, 191–200; parts and supplies, transmitters, receivers, and other instruments, 192, 196; utilization in rural districts, 193; description, 196, 197; induction coils, construction, 196, 197; use for transmission of music, sermons, speeches, etc., 198; exchanges, importance of lightning arrester equipment, 212.
Telephone switchboards, 192, 193, 194; common battery, 194; automatic, 194, 195; cost of construction, 195; private exchanges, 196.
Telluride Power Transmission Co., plant, 634.
Tennessee, ferrophosphorus, production, 30; rank in value of tanning materials produced, 458.
Tennessee Copper Co. plant, 408.
Terne plate, imports, exports, and consumption, 92; produced, 92, 97.
Terrenoire Co., coke ovens, 534.
Tetrachloride, carbon. *See* Carbon, tetrachloride.
Textile fabrics, use in interior electric conduits, 207.
Tharsis mine, Spain, source of pyrites supply, 407.
Thomson, Edgar, works, installation of compound motors for rolling rails, 169.
Thomson, J. M. and W. T., process of manufacture of cellulose nitrate, 472.
Thorp, description of cryolite process of soda manufacture, 423.
Thorp, Frank Hall, on chrome tannage, 459.
Thrasher trucks, 137, 144, 150.
Thrashers, horsepower and steampower, 135, 136, 144, 150.
Tilt Cove mines, Newfoundland, source of pyrites supply, 407.
Tin, used as material, 487.
Tin and terne dipping and black plate combined industry, discussion, 87, 88; establishments and summaries, 87–90; materials used, 89; products, 90; idle establishments, 97; earnings of children in, 649; establishments, wage-earners, and earnings, 722, 730, 740.
Tin and terne dipping industry, establishments, materials used, 90, 91; products, 92; daily capacity of establishments, 93.
Tin compounds, products, 486, 487.
Tin plate, imports, exports, and consumption of, 92; production, 92, 97.
Tin plate, terne plate, and taggers tin, importation and consumption, 92.
Tin salts, produced, 402, 507.
Tinfoil industry, establishments, wage-earners, and earnings, 722, 730, 740.
Tinware industry, establishments, wage-earners, and earnings, 722, 730, 740, 780.
Tires, rubber, 304, 310, 316, 322.
Titanium Manufacturing Co., production of ferrotitanium, 23.
Tobacco, chewing and smoking, and snuff, industry, establishments, wage-earners, and earnings, 649, 722, 730, 740; by specified states, 778, 786, 790.
Tobacco, cigars and cigarettes, industry, establishments, wage-earners, and earnings, 651, 666–669, 722, 730, 740; by states, territories, and geographic divisions, 770; by specified states, 774–790.

Tobacco transplanters, 136, 142, 148.
Tonnage, method of obtaining, 335, 336.
Tools, not elsewhere specified, establishments, wage-earners, and earnings, 722, 734, 740.
Touring cars, automobile, 272, 273.
Townsend, Clinton P., invention of cell for electrolysis of alkali chlorides, 449.
Toy and game industry, establishments, wage-earners, and earnings, 722, 730, 740.
Traction engines, agricultural, 137, 144, 150.
Transformers, production and use, 173, 174.
Traps, four-wheeled, 312, 318, 324.
Tricycles. *See* Bicycles and tricycles.
Tropenas and converters, other than Bessemer, 65.
Trucks, business, 312, 318, 324.
Trunk and valise industry, establishments, wage-earners, and earnings, 722, 730, 740.
Tungsten, use, properties, fundamental and commercial value and processes for utilization, 186, 187.
Turbines, steam, description, 164, 628–631.
Turbo-generators, economic and engineering, 163; types, uses, and average capacity, 164, 165.
Turkey red oil, products, 511.
Turner, Harold J., on utilization of sodium dioxide, 443.
Turpentine, used as material, 463.
Turpentine and rosin industry, establishments, wage-earners, and earnings, 649, 690, 722, 730, 740; by specified states, 776.
Turpentine spirits, produced, 436.
Two-wheeled vehicles, 312, 318, 324.
Type founding industry, establishments, wage-earners, and earnings, 722, 730, 740.
Typewriters and supplies industry, establishments, wage-earners, and earnings, 722, 730, 740.

Umbrella and cane industry, establishments, wage-earners, and earnings, 722, 730, 740.
Union Carbide Co., calcium carbide production, 445, 448.
Union Iron Works, steel cruisers built, 337.
United Kingdom, exports to, 139, 307.
United States, Navy, steel vessels launched, 337; Army, adoption of nitrocellulose powder, 472.
United States Geological Survey, inspection of explosives in mines, 475.
United States Naval Smokeless Powder Factory, rebuilding mixed acids, 416.
United States Signal Corps, adoption of telautograph, 202; submarine cables created, 206.
United Zinc and Chemical Co., contact process plant, 410.
Upholstering material industry, establishments, wage-earners, and earnings, 722, 730, 740.
Utah Sugar Co., electrical transmission plant, 634.

Vacuum tubes and lamps, description, 187–190.
Valentiner vacuum process of nitric acid distillation, 413; results obtained, 414.
Valentinus, Basilius, sulphur used to produce sulphuric acid, 407; muriatic acid preparation described, 417.
Vanadate of iron, produced, 23.
Vanadium Alloys Co., reduction works, 23.
Vanillin, produced, 482, 508.
Varnish, pyroxylin, composition and uses, 467; industry, establishments, wage-earners, and earnings, 722, 730, 740.
Varnished cambric, use in cable insulation, 205.
Varnishes, oil and turpentine, produced, 402, 461, 508, 510; processes of manufacture, 466, 467.
Varnishes and japans, produced and consumed, 508, 510.
Vaseline, method of obtaining, 581.
Vault light and ventilators industry, establishments, wage-earners, and earnings, 722, 730, 740.
Veatch, Dr. John A., discovery of borax by, 424.
Vermilion, process of production, 465.
Vertical turbo-generators. *See* Turbo-generators.
Vessels, iron and steel, and wooden, summaries, 332, 334, 335; products, 333; launched by private shipyards, 336, 337, 339, 340; for United States Navy, 337; steam and other power, 340; sail, launched by private shipyards, 341. *See also* Shipbuilding industry.
Victoria automobiles, 272, 273.
Victorias, pleasure carriages, 312, 318, 324.
Vinegar and cider industry, establishments, wage-earners, and earnings, 722, 730, 740.
Virginia, progress in shipbuilding industry, 334; rank in manufacture of tanning materials, 458.
Virginia-Carolina Chemical Co., chamber process plant, 411.
Virginia Electrolytic Co., production of ferroalloys, 23.
Virginia State Fertilizer Co., chamber process plant, 411.
Vis-a-vis, pleasure carriages, 312, 318, 324.
Viscose, invention of, 477.
Vitriol, blue. *See* Blue vitriol.
Vocalion, description of, 246.

Wage-earners and wages, in specified industries, iron and steel, 4–6, 11, 16, 18, 19; blast furnaces, 25, 27, 41, 42, 46, 72; steel works and rolling mills, 49–50, 76–78; forges and bloomeries, 70; tin and terne plate, 87, 89–91, 94–96; copper, lead and zinc, smelting and refining, 101, 103, 105, 107, 110–115, 119, 121–124, 126; agricultural implements, 129, 131–132, 142, 148; electrical machinery, 158, 159, 218; musical instruments, 239–241, 252, 256, 258, 260, 264, 266; automobiles, 269, 270, 273, 275, 282; bicycles and tricycles, 289, 291, 294; carriages and wagons, 301–303, 307, 310, 316, 322; shipbuilding, 331, 332, 334, 335, 348, 350, 352; steam and street railroad cars, 357, 358, 364, 365, 367–371, 374, 378, 382, 386, 388–390; chemicals and allied products, 398, 399; acids, 404, 417, 504; sodas, 421; alums, 428; coal tar products, 430; cyanides, 432; wood distillation, 435, 505; fertilizers, 438, 496; bleaching materials, 441; electro-chemicals, 444; dyestuffs and extracts, 450, 502; tanning materials, 458; paints and varnishes, 461, 463, 492–495, 500; explosives, 468, 470, 498; plastics, 475, 476; essential oils, 477, 506; gases, compressed and liquefied, 479; chemicals, 482, 486, 490; bone, ivory, and lampblack, 507; coke, 515, 528; petroleum refining, 567, 574.
Wagon bodies, used as material, 304.
Wagons, business, farm, government, municipal, etc., 304–306, 312, 318, 324.
Wagons and wagon trucks, agricultural, 137, 144, 150.
Wall paper industry, establishments, wage-earners, and earnings, 722, 730, 740.
Waltham Abbey Factory, England, process of cellulose nitrate manufacture used, 472.
Washing machine and clothes wringer industry, establishments, wage-earners, and earnings, 722, 730, 740.
Washington Water Power Co., plant, 634.
Watch and clock material industry, establishments, wage-earners, and earnings, 722, 730, 740.
Watch case industry, establishments, wage-earners, and earnings, 722, 730, 740.
Watch industry, establishments, wage-earners, and earnings, 649, 722, 730, 740.
Water motors, number and horsepower, establishments, 620.
Water paints, dry or in paste, produced, 508, 641.
Water paints and kalsomine, produced, 508.
Waterpower, establishments using, 40; discussion, 629–631; industries reporting, 631; utilization, 635.
Water trucks, agricultural, 137, 144, 150.
Water wheels, number and horsepower, 619, 620.
Watt hour meters, construction, 214; women employed in manufacture, 214.
Wax, paraffin, average value per barrel, 570; increase in quantity, 571.
Webb, Herbert Laws, on the advantages of incandescent lamp signals in telephonic practice, 194.
Weeders, 144, 150.
Weeks ovens. *See* Ovens.
West Indies, exports to, of automobiles and automobile parts, 276; steam railroad, passenger, and freight cars, and parts of same, 367.
West Virginia, rank in value of iron and steel products, 6, 8; use of natural gas as fuel, 52; production of nail plate, 55; skelp, 55; iron black plates, 56.
Western Chemical Co., chamber process plant, 411.
Western division, sulphuric acid produced, 406.
Western North Central division, discussion relative to industries, wage-earners, and

earnings, 693–697. *See also* Geographic divisions.
Western South Central division, discussion relative to industries, wage-earners, and earnings, 699–701. *See also* Geographic divisions.
Western states, iron and steel industry, 22.
Western Union Telegraph system, offices equipped and remodeled, 200.
Wheatstone automatic transmitter, use in printing telegraphy, 201.
Wheelbarrow industry, establishments, wage-earners, and earnings, 649, 722, 730, 740.
Wheels, used as material, 304.
Whip industry, establishments, wage-earners, and earnings, 722, 730, 740.
White lead, dry, produced, 402, 461, 508, 510; consumed in establishments where manufactured, 403; in oil, produced, 461, 508, 510; ancient uses of, 463; used as material, 463, 508, 510; English process of manufacturing, 464.
Whiting, used as material, 463.
Whitney Reduction Co., plant, 634.
Wilke, on Mannheim process sulphuric acid extraction, 410.
Willson Aluminum Co., production of ferroalloys, 22.
Windmill industry, establishments, wage-earners, and earnings, 722, 730, 740.
Windmills, 137, 144, 150.
Window shades and fixtures, industry, establishments, wage-earners, and earnings, 722, 730, 740.
Wine lees, imports, 488.
Winnipeg General Power Co., plant, 634.
Wintergreen oil, produced, 477, 512.
Wire, rods, used as material, 13, 78; products, 52–54, 57–60; cordage, ship and boat building, 348, 350.
Wire and wirework industries; establishments, wage-earners, and earnings, 722, 730, 740.
Wireless telegraph, apparatus, value, 200. *See also* Telegraph systems.
Wisconsin, rank in value of iron and steel products, 7, 8; in waterpower used, 629.
Witch hazel, produced, 402; extract, 477, 512.
Wood, used as material, 244, 400, 470, 509, 511, 512; fiber, use in soda manufacture, 424; preserving industry, establishments, wage-earners, and earnings, 722, 730, 740; turned and carved, establishments, wage-earners, and earnings, 722, 730, 740.
Wood alcohol, refined, produced, 401, 437, 512; crude, 435; pine, 436; exported, 437; used as material, 512.
Wood ashes, used as material, 400, 440, 507, 509.
Wood carpet industry, establishments, wage-earners, and earnings, 649, 722, 730, 740.
Wood distillation, discussion relating to classes, production, and development of industry, 434–437; by states, 505, 512; establishments, wage-earners, and earnings, 722, 730, 740.
Wooden vessels. *See* Vessels, iron and steel, and wooden.
Wooden ware (not elsewhere specified), establishments, wage-earners, and earnings, 722, 730, 740.
Wool pulling industry, establishments, wage-earners, and earnings, 722, 730, 740.
Wool scouring industry, establishments, wage-earners, and earnings, 722, 730, 740.
Woolen goods industry, power used, 621, 622, 623, 624, 628; establishments, wage-earners, and earnings, 651, 722, 730, 740; by states, territories, and geographic divisions, 722; by specified states, 774, 780, 784, 788, 790.
Women, children, and negroes, employed in North and South Carolina, effect on earnings, 678.
Worcester, William F., section on Musical instruments, attachments, and materials, 239.
Worsted goods industry, increase in consumption of horsepower, 620; power used, 621, 622, 623, 624; size of steam engines employed, 628; establishments, wage-earners, and earnings, 651, 722, 730, 740; by states, territories, and geographic divisions, 772; by specified states, 780, 784, 788.
Writing telegraph systems. *See* Telegraph systems.
Wyoming, children employed as wage-earners, 680.

X-ray bulbs, use in surgical operations, 187.

Yellow metal, including bolts and spikes, used in shipbuilding, 348, 350–353.
Yellow prussiate of potash, imported, 434; produced, 507.

Zinc and zinc dross, used as material, 487.
Zinc lead, Joseph H. Pratt quoted in regard to production and value, 464.
Zinc oxide, produced, 125; used as material, 476.
Zinc salts, produced, 486.
Zinc smelting, comparative summaries, 101, 123, 124; idle establishments, 122; products, 122–125; detailed summary, 125, 126.
Zinc white, used as material, 463, 508, 510; methods of production, 465.
Zirconium, use of, 186.

O